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Comparison of the 1982 SEADEX Dispersion Data With Results From a Number of Different Models

ORIGINAL

Prepared by W. S. Lewellen, R. I. Sykes, C. P. Cerasoli, F. C. Kornegay

Aeronautical Research Associates of Princeton, Inc.

Prepared for
U.S. Nuclear Regulatory Commission

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Prepared by
W. S. Lewellen, R. I. Sykes, C. P. Cerasoli, F. C. Kornegay*

Aeronautical Research Associates of Princeton, Inc.
50 Washington Road
P.O. Box 2229
Princeton, NJ 08540

*Oak Ridge National Laboratory, P.O. Box X, Building 2001
Oak Ridge, TN 37830

Prepared for
Division of Engineering Safety
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555
NRC FIN B0446

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Abstract

The results from simulations by 12 dispersion models are compared with observations from an extensive field experiment conducted by the Nuclear Regulatory Commission in a shoreline environment during the early summer 1982. Ten of these models are the same as used in the earlier comparisons with the 1981 field tests at Idaho National Engineering Laboratory. All the models performed better on this SEADEX experiment. Little difference between the models is evident with hourly surface data, with the models able to predict the maximum value in the neighborhood of a sampler site within a factor of 2 approximately 25% of the time. This is raised to approximately 40% when the comparison is based on 12 hour integrated dose. For the longer time samples the more sophisticated models do show a distinct advantage when measured by correlation coefficient and root mean square error. If the data file is assumed incomplete, with higher data samples possible between the actual data samples, then the best results for the hourly samples show over 80% calculated within a factor of 2 when a 15^{0} uncertainty in the plume position is permitted. This is raised to 90% for the 12 hour dose on the same comparison basis. We believe the data for this experiment are of sufficiently high quality that the more stringent interpretation of these tests given first are justified.

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I. INTRODUCTION

This report is one of a series of reports supported by the Nuclear Regulatory Commission's program to evaluate available dispersion models for use as emergency response models. As part of this program, an extensive field experiment was carried out near the Kewaunee nuclear power plant in Wisconsin during early summer 1982. SRI International was responsible for the design and direction of the field study which has been described in 3 reports (Johnson, et al., 1984). The models chosen for comparison with the data are similar to those used earlier to compare with the 1981 INEL data (Lewellen, et al., 1985). This stable of models include 4 Gaussian plume models with straight line trajectories; 5 Gaussian puff models with spatially and temporally varying winds; and 3 more sophisticated transport and diffusion models.

The field experiment was specifically designed to provide high-quality dispersion data within a coastal zone. Section II provides a review of the data used in this model comparison. Detailed surface contours of the tracer samples are given in Appendix A. Indications are that a lake breeze recirculation cell was established during part of these tests. Thus, this data set provides a good complement to the earlier INEL data.

Section III provides a review of the model results for this data set. A part of these model results are presented in Appendix B for direct qualitative comparison with the data in Appendix A. Section IV provides intermodel comparisons using the pattern test previously developed for this emergency response application (Lewellen, Sykes, and Oliver, 1982). Model performances were better in this test than on the earlier INEL tests. However, the more sophisticated models only show a marginal advantage over the simple Gaussian plume models.

II. REVIEW OF THE DISPERSION DATA

Deployment of the various instrumentation systems during the SEADEX experiment are illustrated in Figure 1 taken from Johnson, et al., (1984). A tracer gas was released at a height of 41 m for periods of 4 to 9 hours over 9 days between 28 May and 8 June for a total of 50 hours. One hour surface bag

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samples were taken at the indicated locations both during the release and for a time following the cessation of each release. The airborne tracer measurements described by Johnson, et al., (1984) were not used in this model comparison.

The primary meteorological input to the models were the meteorological measurements made at heights of 12.3 m and 55.2 m on the instrumented tower at the source release point; the mixing depth data taken from 2 sodar units, the mark-9 mobile lidar system, rawinsondes, and the aircraft spiral soundings; the mesonet winds provided by the 11 10 m meteorological towers; wind profiles and the tetroon tracks provided by the balloon tracking radar; and the wind and ΔT measurements on the 91 m radio tower 34 km west of the tracer release point.

Low level winds were generally on shore during all the tests. However, strong vertical wind shear was often present so that winds in the vicinity of the top of the boundary layer were sometimes reversed to exhibit a classical lake-breeze circulation. The re-circulation is not specifically included by any of the models although some features of the resulting flow may be treated by the more sophisticated models.

The tracer surface patterns for all of the individual hours and the total integrated dose for each 4 to 9 hours release are plotted in Appendix A. Although many of the individual hours are quite patchy, the total integrated dose for each of the periods resembles the footprint of a relatively coherent plume. Comparison between these surface patterns and those obtained in the 1981 INEL field experiment (Lewellen, et al., 1985) show the SEADEX patterns to be significantly more coherent. This is probably a reflection of the somewhat more stationary meteorology during the SEADEX experiment, as well as the fact that mixing layer depths during afternoon conditions were much larger at the INEL site.

With the exception of GX, all of the models use a mixed layer depth which is horizontally homogeneous at any given time. This is a problem in the shoreline environment where the mixed layer height is known to vary and where two or more inversions often show up on a temperature sounding. Most of the models were run with both a shallow mixed layer and a standard mixed layer. Although this made significant difference on some individual model hours it

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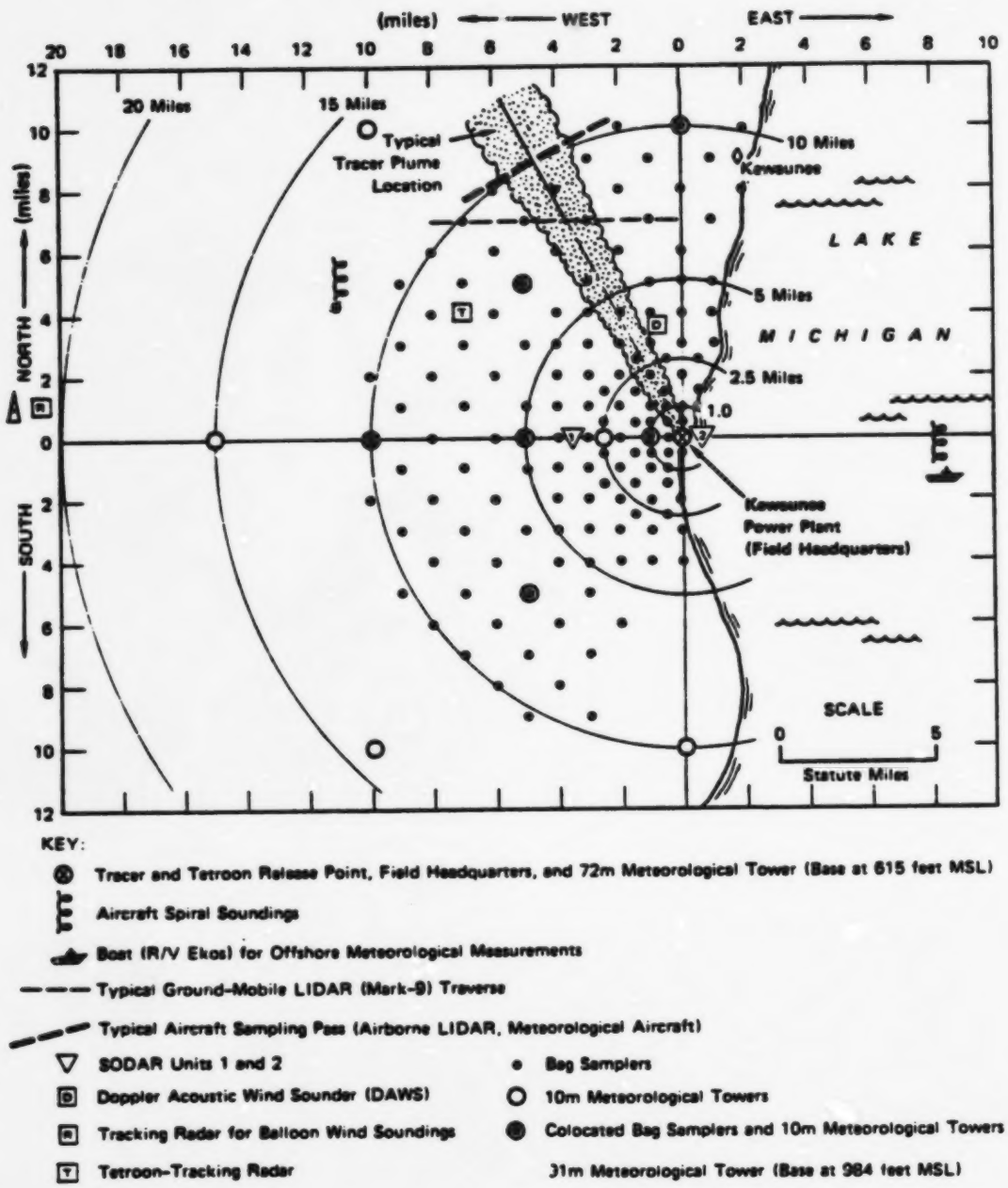

KEY:

- Tracer and Tetroon Release Point, Field Headquarters, and 72m Meteorological Tower (Base at 615 feet MSL)
- Aircraft Spiral Soundings
- Boat (R/V Ekos) for Offshore Meteorological Measurements
- Typical Ground-Mobile LIDAR (Mark-9) Traverse
- Typical Aircraft Sampling Pass (Airborne LIDAR, Meteorological Aircraft)
- SODAR Units 1 and 2
- Doppler Acoustic Wind Sounder (DAWS)
- Tracking Radar for Balloon Wind Soundings
- Tetroon-Tracking Radar
- Bag Samplers
- 10m Meteorological Towers
- Colocated Bag Samplers and 10m Meteorological Towers
- 31m Meteorological Tower (Base at 984 feet MSL)

Fig. 1. Instrumentation Deployment Used in SEADEX-I.

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did not make a noticeable difference in the model comparison results shown in section 4.

III. INDIVIDUAL MODEL RESULTS

Detailed surface patterns as simulated by the individual models are presented in Appendix B. We have chosen to show the total integrated dose and the pattern for 3 representative hours from each of the test periods. These are all plotted on the same size plots to permit ready comparisons with the data in Appendix A and intermodel comparisons.

3.1 Gaussian Plume Models; TE, IS, GP, GX

TEM (TE) was designed by the Texas Air Control Board, Christiansen (1976), to evaluate ground level, short-term concentrations of atmospheric pollutants. It is a straightforward steady state Gaussian plume model using a version of the Pasquill-Gifford-Turner dispersion parameterization based on stability classifications. For the details of this parameterization see either Lewellen et.al. (1985) or the original reference.

ISC (IS) was designed for EPA to evaluate the effect of an industrial source of pollutants on nearby communities, Turner (1979). It contains a similar, but somewhat different version of dispersion parameterization based on stability categorizations.

We have included another Gaussian plume model (GP) designed with σ_y determined directly by measurements of the wind variance. The inclusion of this model seeks to determine whether this more direct determination of dispersion leads to improved model performance.

The final Gaussian plume model is an adaptation of Glump II (Lyons, et.al., 1983) which was specifically designed for the coastal environment. This GX model is an addition to the set of models considered in our earlier INEL study. Its most unique feature is the incorporation of a mixed layer height which is a function of distance from the shoreline. The parameterization for this mixed layer variation follows the parameterization of the TIBL (Turbulent Internal Boundary Layer) given by Lyons. The meteorological data shows that the inversion height does change significantly

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with distance from the shoreline under the conditions of onshore winds prevalent during this set of tests. Inclusions of this effect should be expected to improve model performance.

A cursory comparison of these model simulation results in Appendix B with the observations of Appendix A shows some hits and some misses. There appears to be better agreement with the total dose than with the individual hourly patterns. Of course, none of the hourly data showing plume material in the network for some time after the emissions cease can be simulated by these steady state models.

3.2 Gaussian Puff Models; MI, 2M, AR, MJ, MT

One of the models, mesodiff, in the earlier study has been replaced in this study by MESOI2.0 (2M). This is a revision (Ramsdell, et.al. 1983) of the earlier MESOI (MI) (Ramsdell and Athey, 1981). MESOJ (MJ) is our modification of MESOI to correct some perceived omissions (Lewellen, et.al. 1985). The other 2 puff models are quite different. The ARL-puff model (AR), designed for longer range transport (Draxler, 1979) uses a constant spread ratio of 1 m/sec. MESOT (MT) takes the observed tetroon trajectories and applies the MESOI diffusion algorithms.

As may be noted by review of Appendix B there is little difference between the results of the 3 MESOI models. The results for MESOT are somewhat more distinct, particularly for test #3. The relatively strong wind shear in the coastal environment apparently caused the tetroon to go in the wrong direction when they tracked winds at a somewhat higher altitude. The ARL model appears to give the poorest qualitative comparison. The puff is swept out of the domain too rapidly. Apparently the influence of the upper level winds on the model is too strong for this short range.

3.3 Transport and Diffusion Models; PA, AD, SP

One model, IMPACT, has been dropped from the earlier stable of models in this group. These models all use a 3-D wind field generated by a MATHEW type model. Splitpuff (SP) is the simplest of these three. It is a puff model (Lewellen et.al., 1985) with the ability to split an existing puff into a number of smaller puffs when wind shear dictates. It also merges existing

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puffs when the overlap makes following too many puffs redundant.

PA and AD are our simulations of the Lawrence Livermore Laboratory codes PATRIC and ADPIC which were reviewed in detail by Lewellen et.al, 1981. They show reasonable qualitative agreement with the total dose but not near as much agreement with the hourly samples. Splitpuff appears frequently to over predict the impact.

IV. INTERMODEL COMPARISONS

We use the same basic comparisons between model results and data as presented in our earlier evaluation using the INEL data. The basic comparison is the pattern test described by Lewellen, Sykes, and Oliver (1980). This provides a consistent means of seeing how much the comparison between observations and model is influenced by shifts in model pattern positions. The measures of accuracy chosen for intermodel comparisons here are fraction within a factor of two, fraction within a specified absolute increment, root mean square error, and the correlation coefficient. The first two are chosen because they provide easy interpretation, while the last two are preferred by statisticians.

The model shift in position is compared in two ways. For comparisons labelled as "data value" the comparison is between any specific data value and the model prediction which is closest to that data value within the area designated by the angular increment. For comparisons labelled as "max data value" the comparison is centered about any specific sampler site but the comparison is between the maximum observation and the maximum model result within the area designated by the angular increment. Both measures are the same at $\Delta\theta = 0^{o}$. The first approach gives the model the greatest possible benefit of any uncertainty in predicted position, while the second approaches the standard paired-in-time-only result at large values of $\Delta\theta$. The greatest discrepancy between the two measures will occur when the model predicts results significantly greater than any observations. Since the SEADEX data are smoother than the earlier INEL data, it is reasonable to believe that the data network has correctly captured the maximum surface impact. If this is true then the second measure should provide a more reliable assessment of the model accuracy.

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Figures 4.1 to 4.4 show the comparisons for the total dose under the conditions which are most favorable to the model. It is readily apparent that all of the models perform better on this set of tests than on the earlier INEL tests. This is even more apparent when the more stringent max-data-value comparison is made in Figs. 4.5 to 4.8. This is most noticeable when Figs. 4.5 and 4.6 are compared with the corresponding Figs. 4.6 and 4.7 in Lewellen, et.al., 1985 where MT was the only model to score significantly above 20% within a factor of 2. In this set, none of the models score significantly below 30-40% within a factor of 2. The correlation coefficients are all significantly higher.

The hourly dose comparisons in Figs. 4.9 to 4.16 also show some improvement over the earlier test results but not as much as the total dose comparisons. In fact the critical correlation coeff'cient comparison on the max-data-value basis in Fig. 4.12 still shows little meaningful correlation.

Model performance is very dependent on the measure of performance, and quite divergent modeling positions can be supported by choosing different measures. The contrast in conclusions are illustrated by the following examples:

The simple gaussian plume modelers may note that these models have been shown to have an adequate performance based on Fig. 4.8 which show approximately 70% of the hourly data calculated within a factor of 2 when 15° uncertainty in position is permitted.

A MESOI proponent could conclude from Fig. 4.8 that it is a very good model based on predicting 85% within a factor of 2 when a 15° uncertainty in position is permitted.

A GLUMP advocate could point with pride to Fig. 4.1 and the fact that the total dose for each sampler for each case was calculated within a factor of 2 90% of the time when a 15° uncertainty in position is permitted. The same proponent could point out from Fig. 4.4 that over 90% of these samples were simulated within 1 ppm-sec on the same position uncertainty basis.

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An ARAC enthusiast may point to Fig. 4.6 and 4.7 and the fact that the PATRIC and ADPIC simulations of the total dose show better correlations and lower r.m.s. errors with the max data values than any of the other models tested.

The model skeptic can point out from Fig. 4.13 that there is little significant correlation between any of the model simulations and the hourly data when the sampler data is assumed to have completely defined the surface pattern. This is true regardless of any permitted simulated plume position uncertainty.

We believe the data for this experiment are of high enough quality that the more stringent interpretation of these tests are justified. Thus conclusions based on Figs. 4.5 to 4.7 and 4.12 to 4.14 are on firmer ground than those based on the other figures in this section.

V. CONCLUDING REMARKS

If it is assumed that this data correctly captured the surface dose distribution during any given hour then the models were only able to predict the maximum value in the neighborhood of a sampler site within a factor of 2 approximately 25% of the time. This is true even when a 45° uncertainty in the plume position is permitted. There is little significant difference between the models on the basis of this particular hourly measure.

The models perform better when predicting the 12 hour integrated dose, approximately 40% within a factor of 2, still with little significant differences between models. However, the more sophisticated models do show a distinct advantage when measured by correlation coefficient and root mean square error.

The tests performed here can not distinguish the cause of the large discrepancies between model simulations and observations. There are 4 basic types of errors: 1) model structure errors; 2) errors in model input quantities; 3) data errors; and 4) unpredictable turbulent variations. We believe #4 is a major source of error for the hourly comparisons but it should be much less important in the total dose comparisons. We believe this is the reason for the better performance on the total dose comparison. This better

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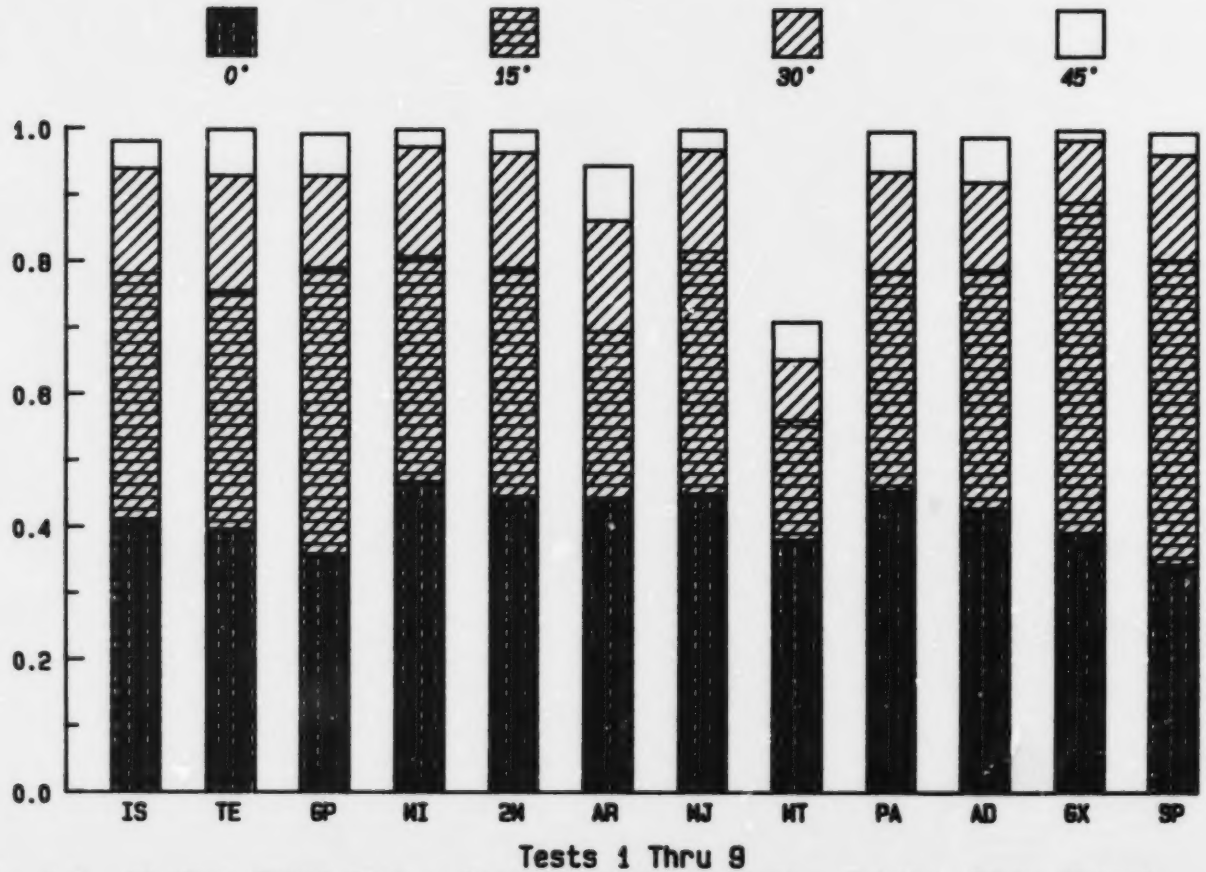

Fig. 4.1 12 Hour Total Dose : Percent within a factor of 2 : (Data Value)

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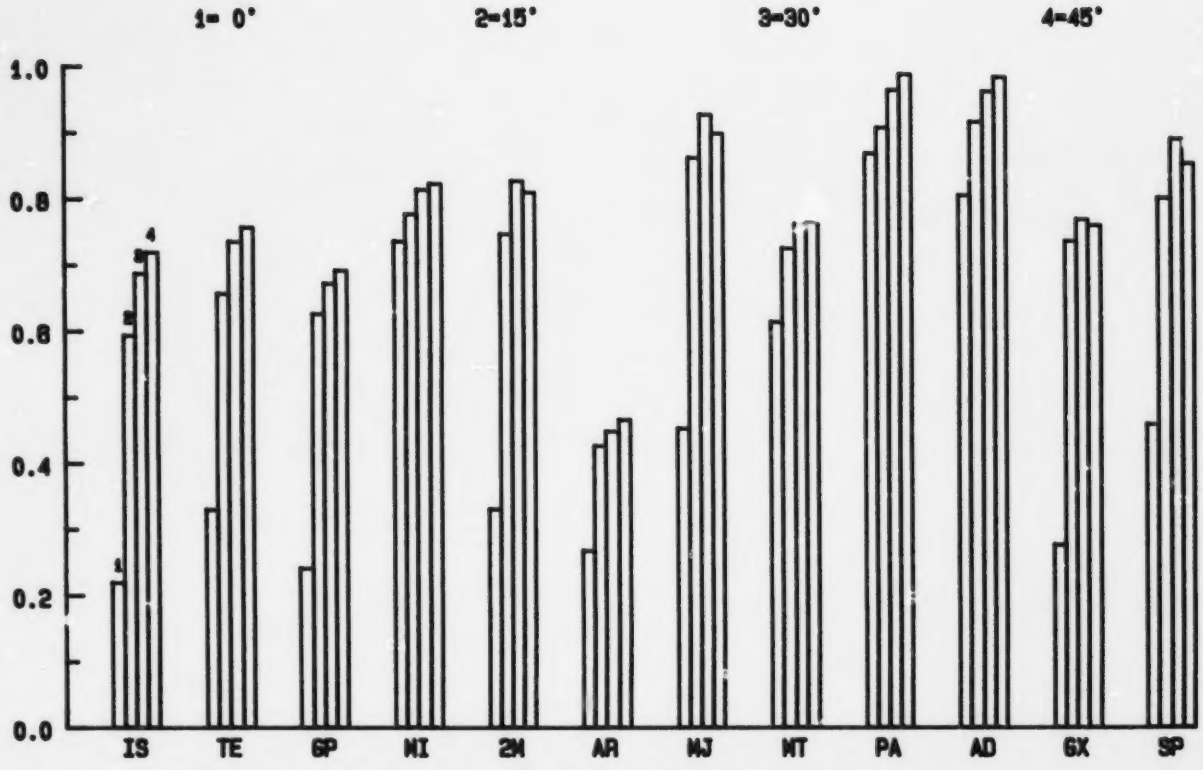

Fig. 4.2 12 Hour Total Dose : Correlation Coefficient : (Data Value)

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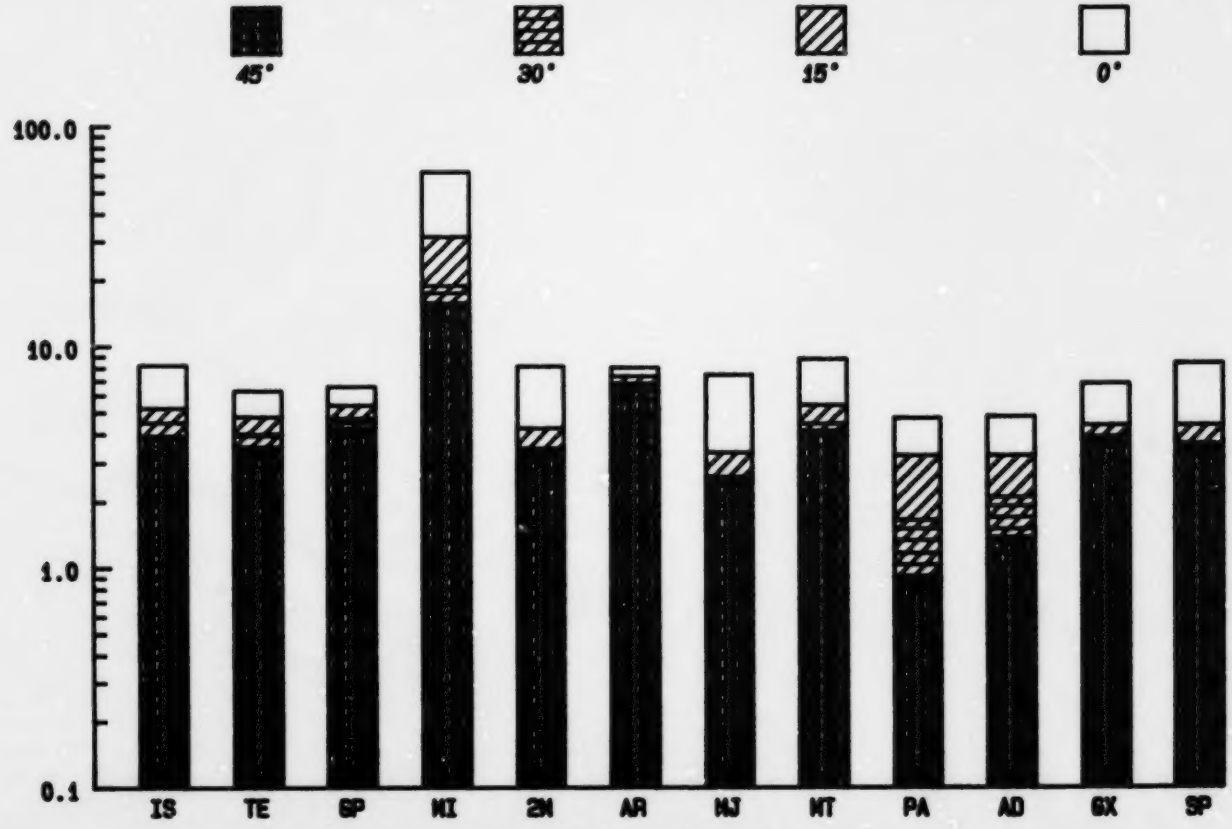

Fig. 4.3 12 Hour Total Dose : Root Mean Square Error : (Data Value)

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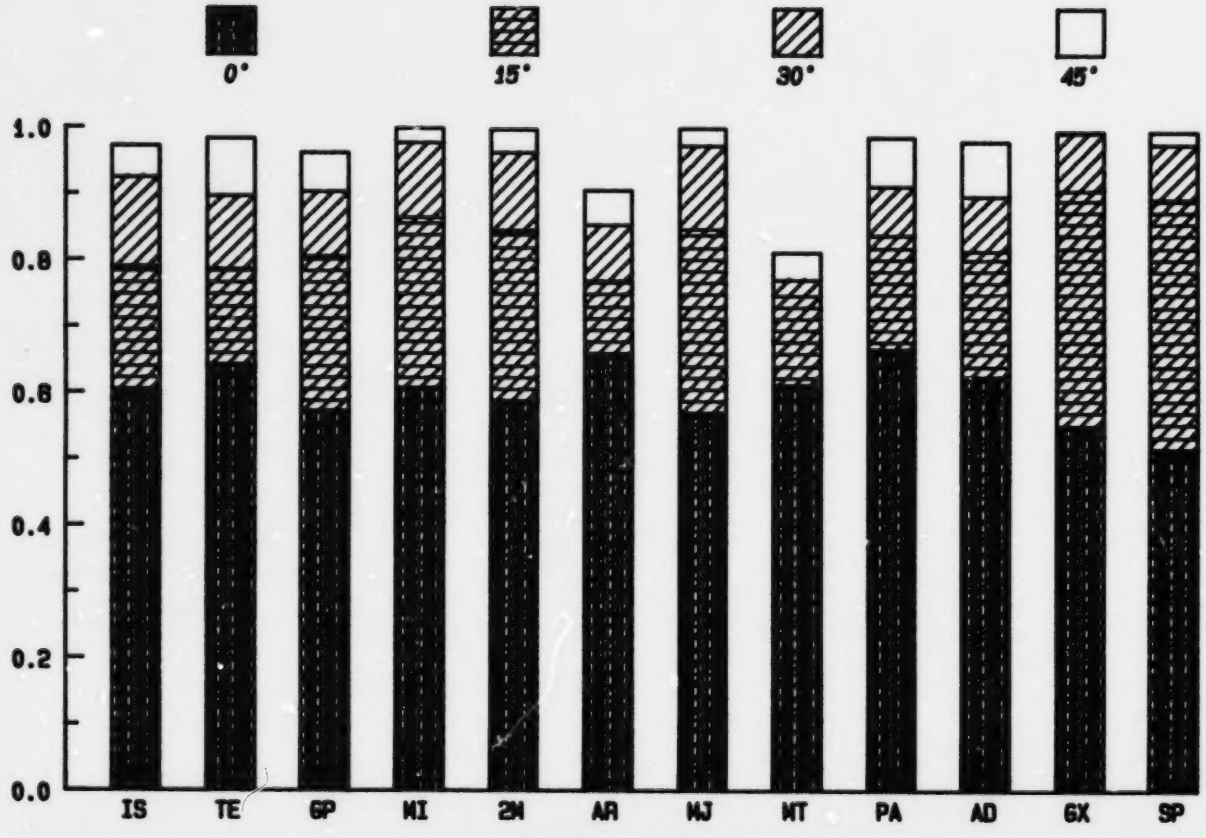

Fig. 4.4 12 Hour Total Dose : Percent within 1 PPM-Sec : (Data Value)

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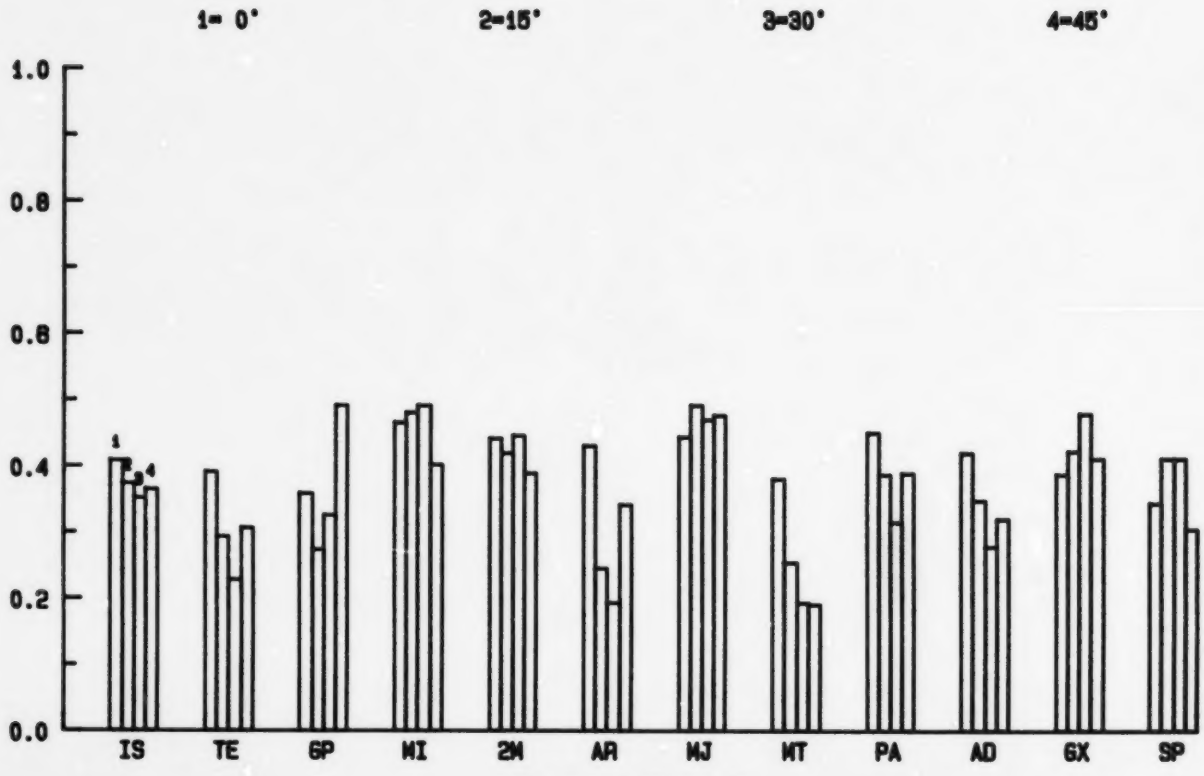

Fig. 4.5 12 Hour Total Dose : Percent within a factor of 2 : (Max Data Value)

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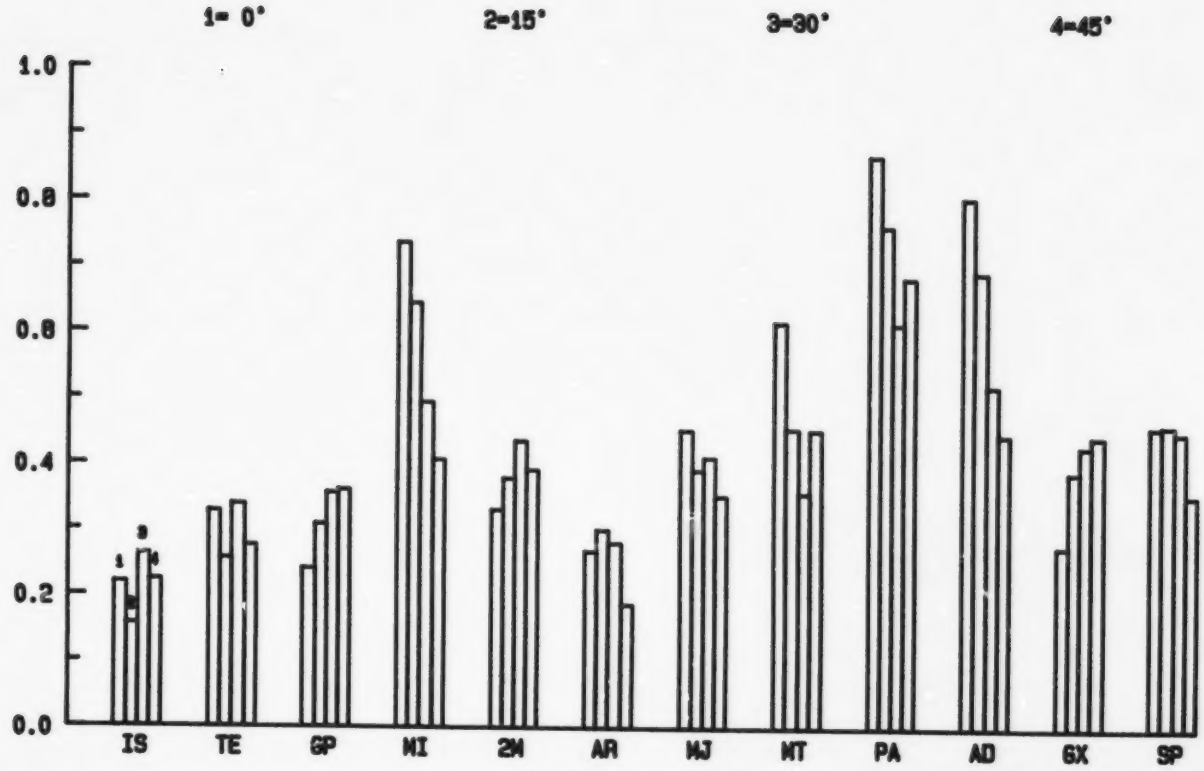

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Fig. 4.6 12 Hour Total Dose : Correlation Coefficient : (Max Data Value)

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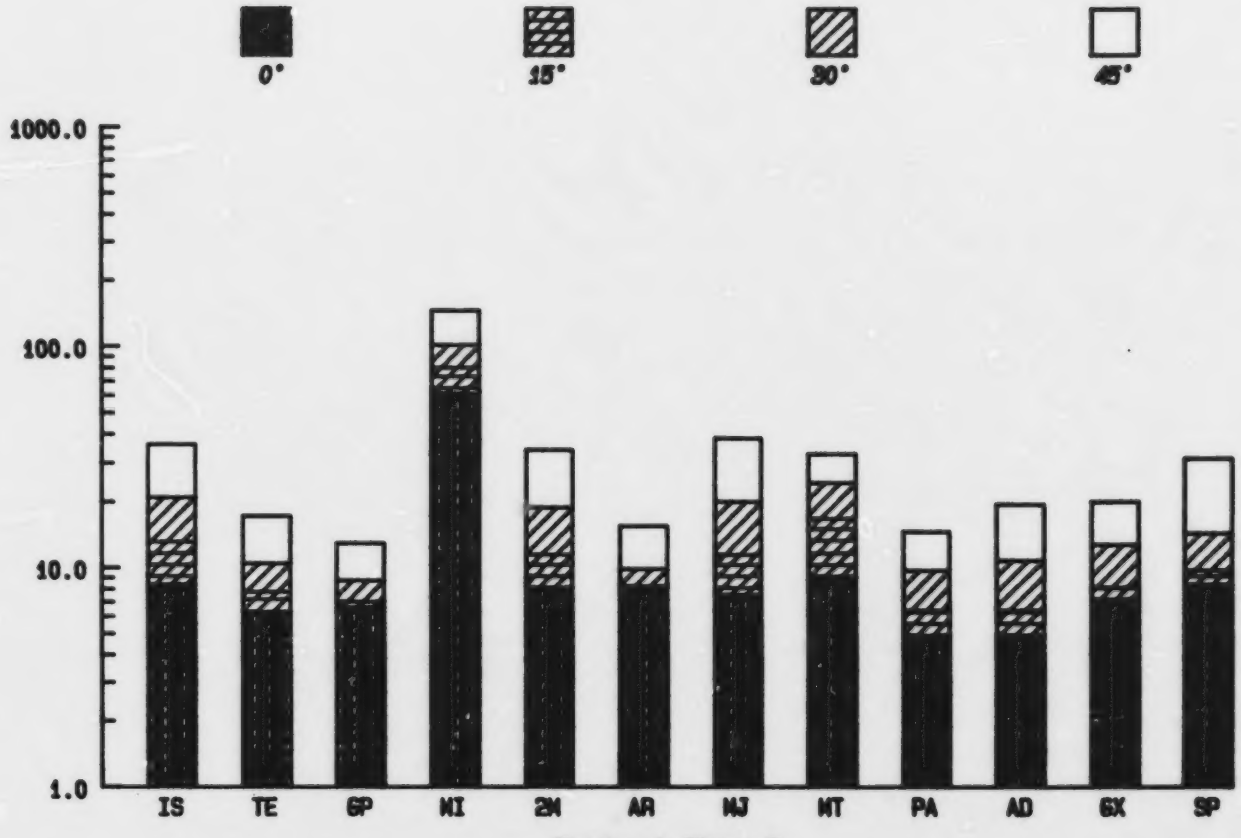

Fig. 4.7 12 Hour Total Dose : Root Mean Square Error : (Max Data Value)

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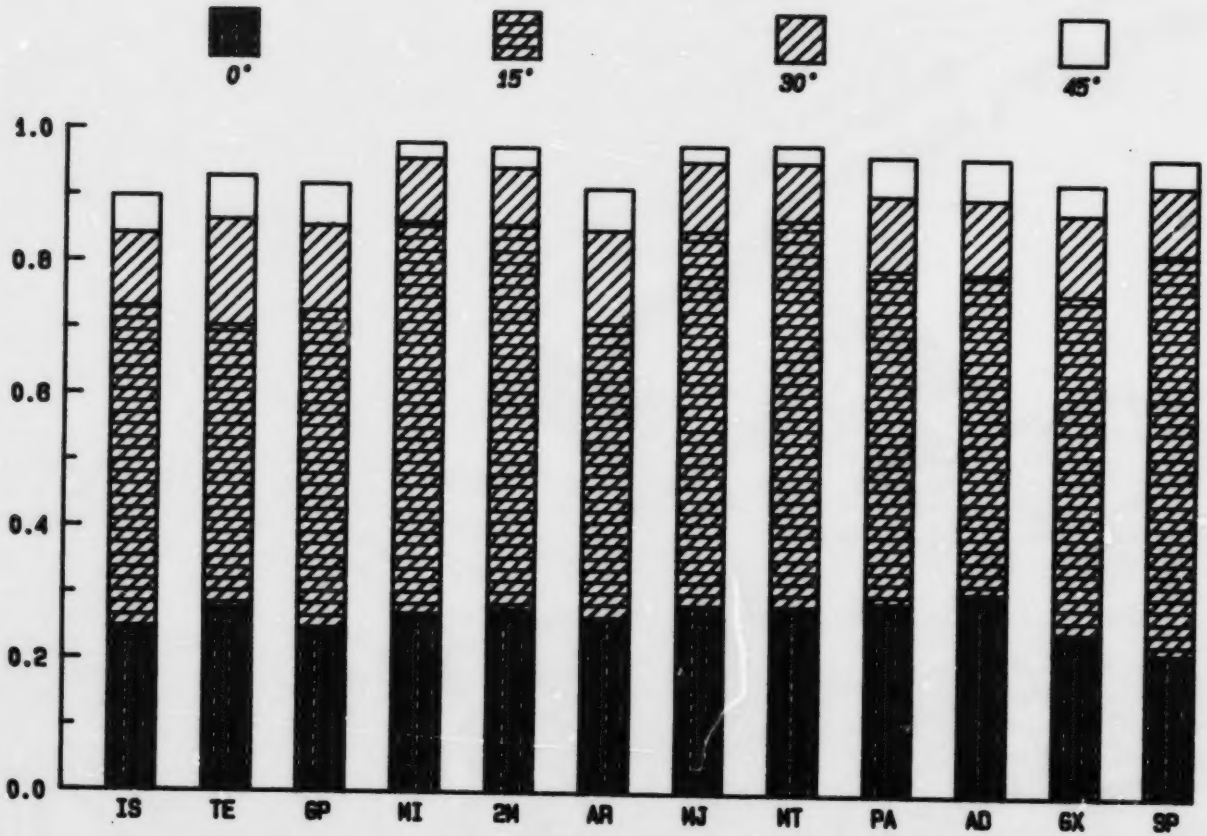

Fig. 4.8 12 Hourly Doses : Percent within a factor of 2 : (Data Value)

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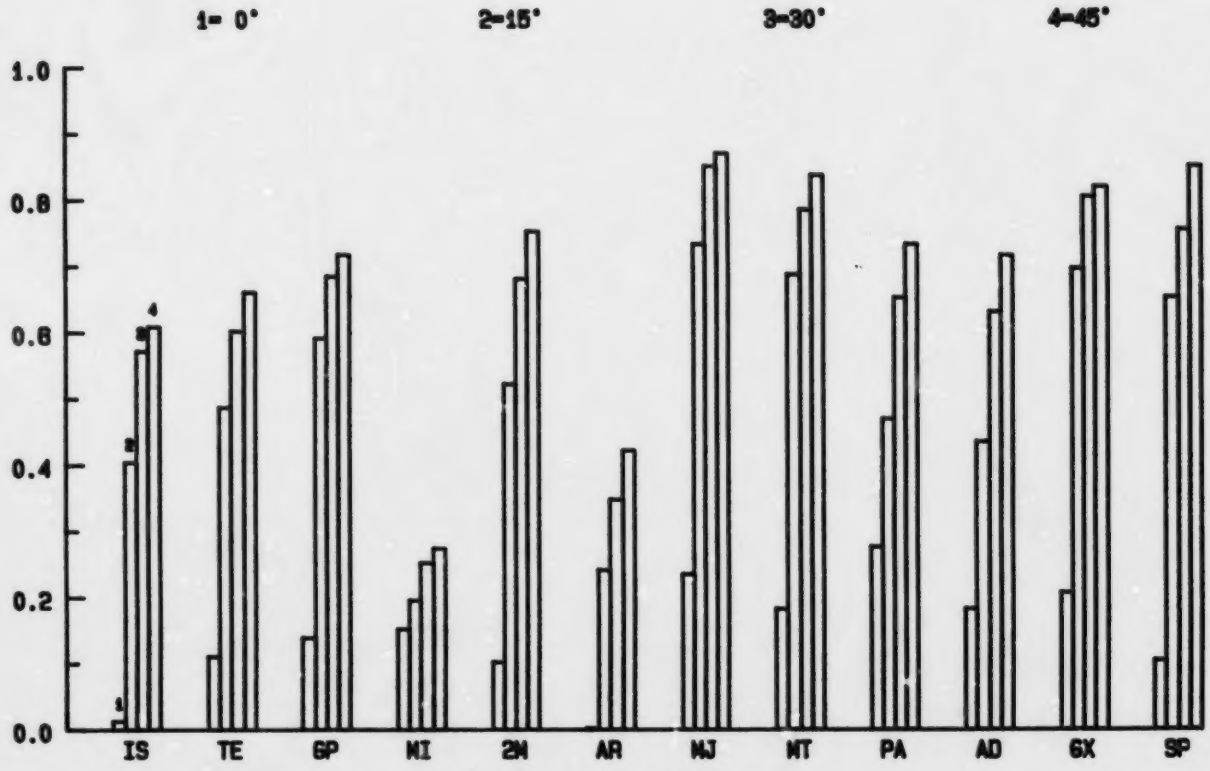

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Fig. 4.9 12 Hourly Doses : Correlation Coefficient : (Data Value)

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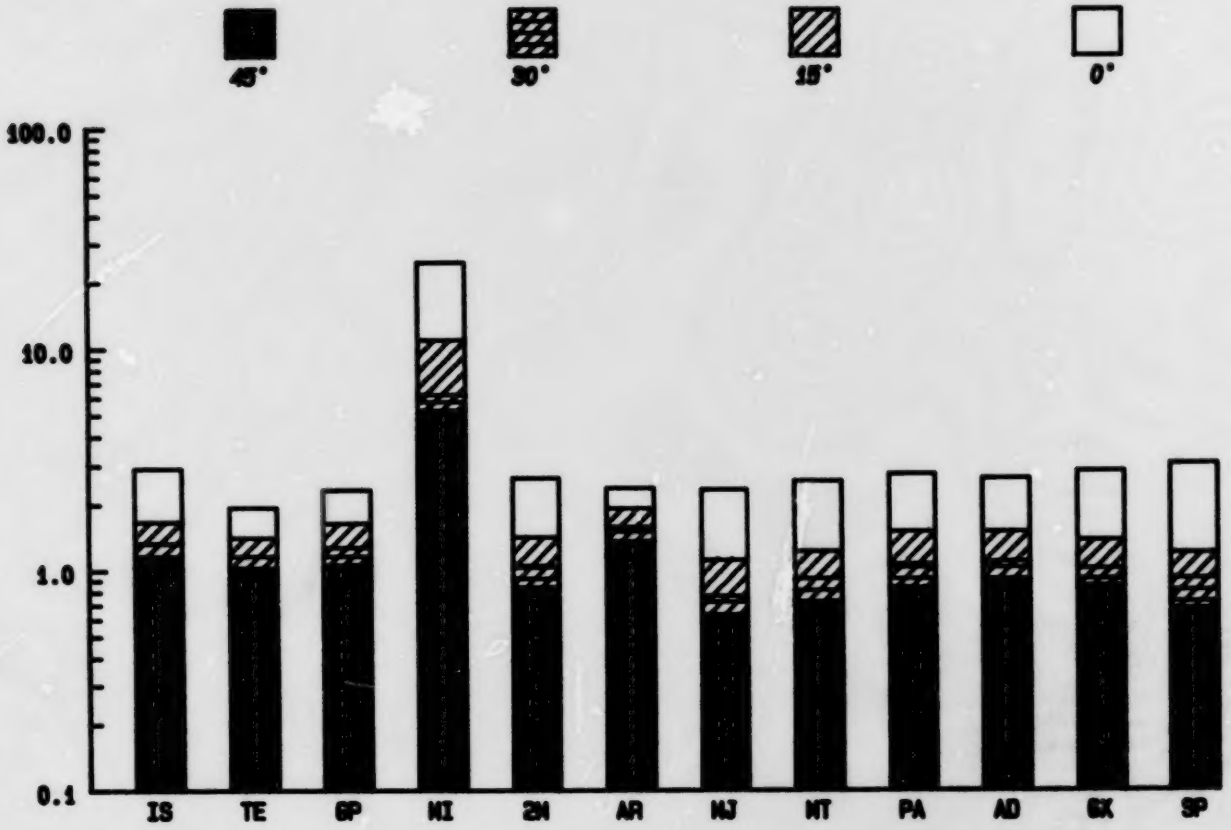

Tests 1 Thru 9

Fig. 4.10 12 Hourly Doses : Root Mean Square Error : (Data Value)

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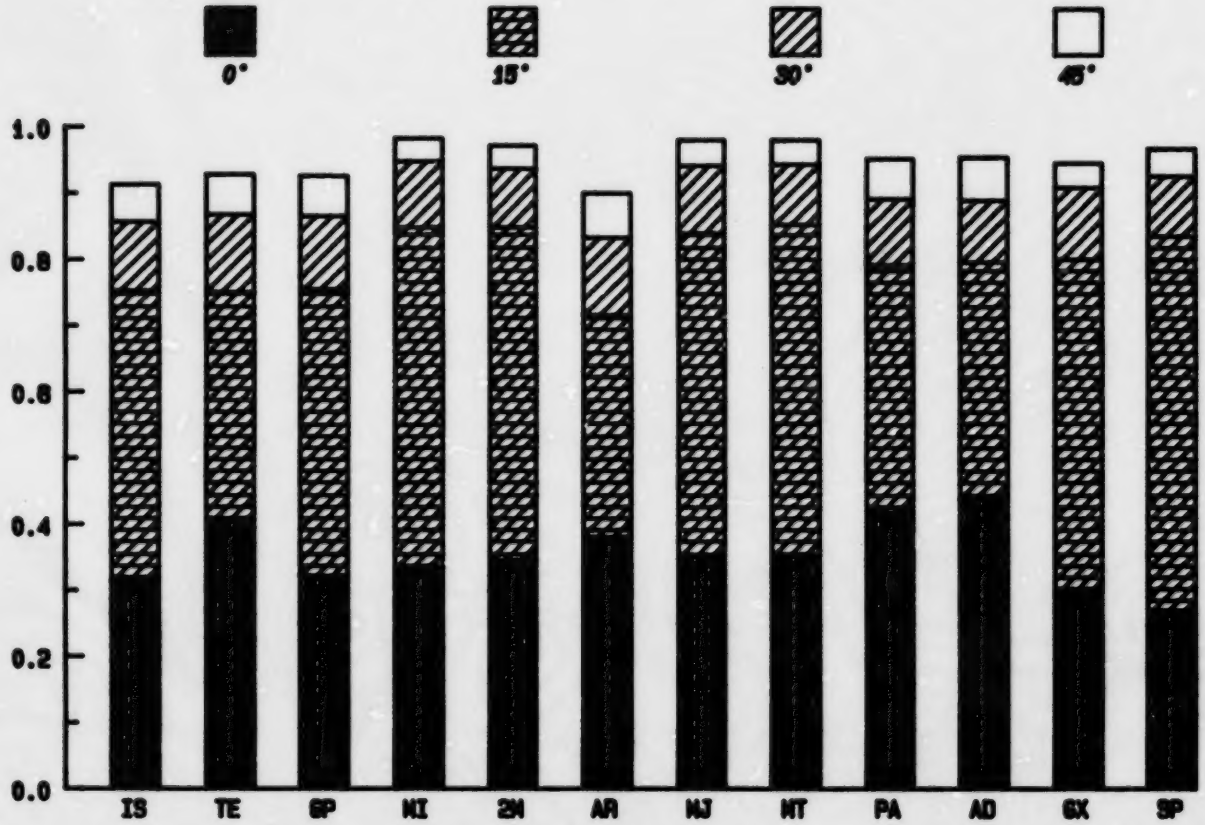

Tests 1 Thru 9
12 Hourly Doses : Percent within 0.1 PPM-Sec : (Data Value)

Fig. 4.11

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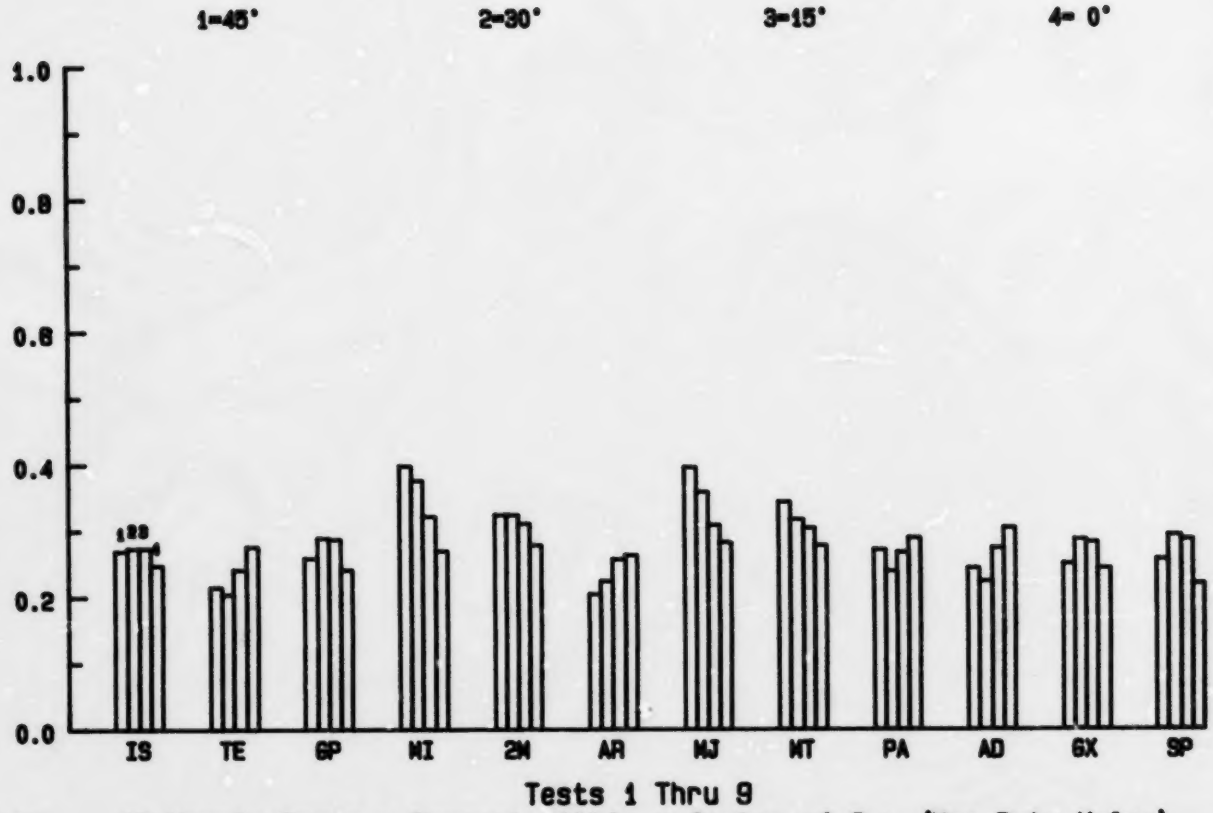

Fig. 4.12 12 Hourly Doses : Percent within a factor of 2 : (Max Data Value)

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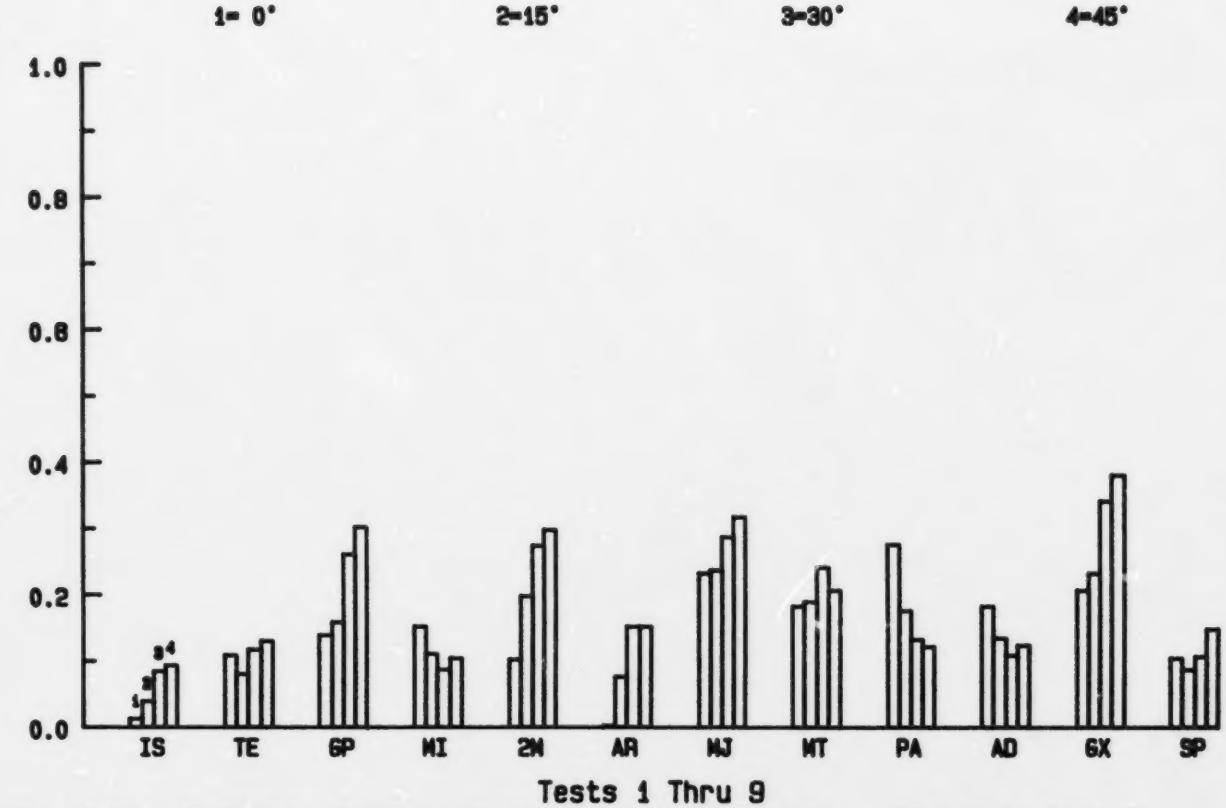

Fig. 4.13 12 Hourly Doses : Correlation Coefficient : (Max Data Value)

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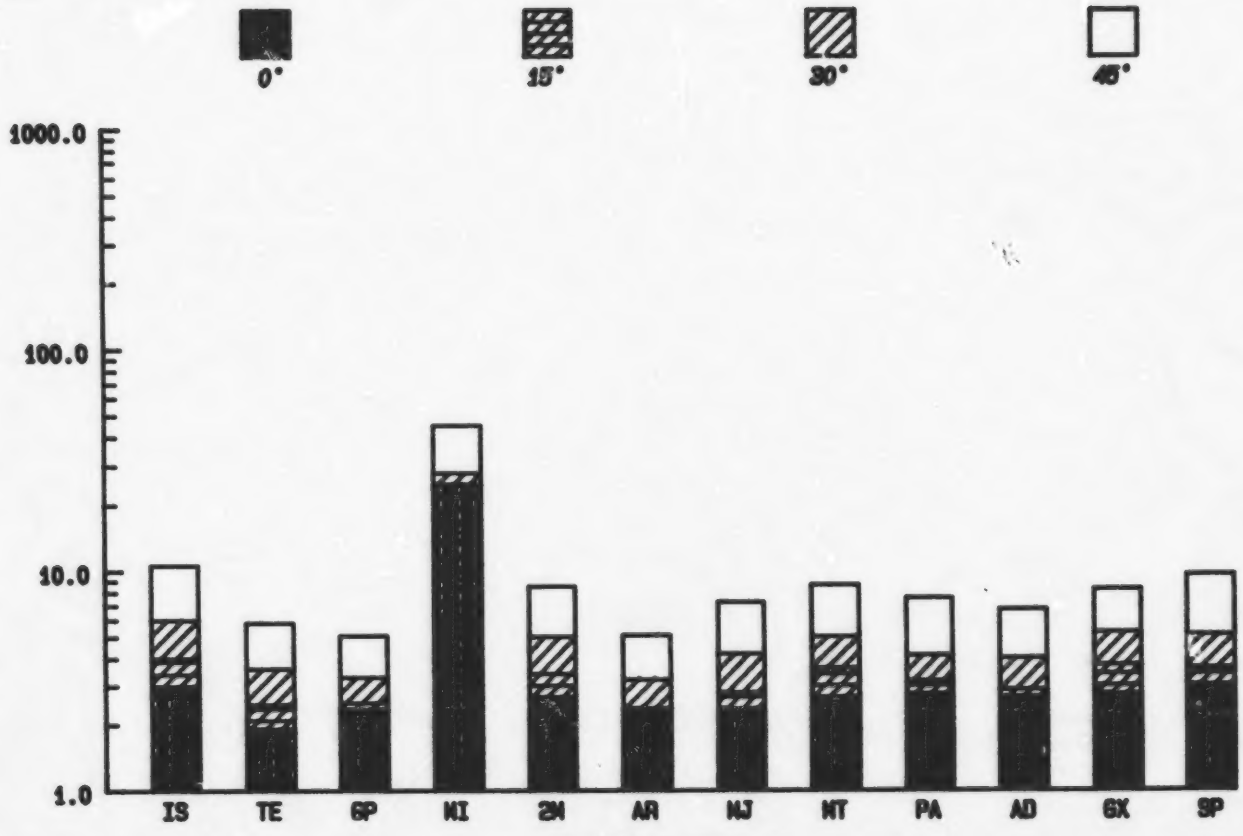

Tests 1 Thru 8

Fig. 4.14 12 Hourly Doses : Root Mean Square Error : (Max Data Value)

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performance also allows some dependence on model structure to be seen. However, unless one is willing to assume either large data errors or large model input errors it certainly indicates the need for improvements in model structure.

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Appendix A

SF_6 Sampler Data

The surface patterns as determined by SF_6 sampler network are presented here for all the hours of the 9 test cases. The total dose for each case, determined by summing over the individual hours, is shown first; followed by the individual hours. For some tests, the sampler network was turned on a few hours before the release began. These null hours are omitted from this presentation.

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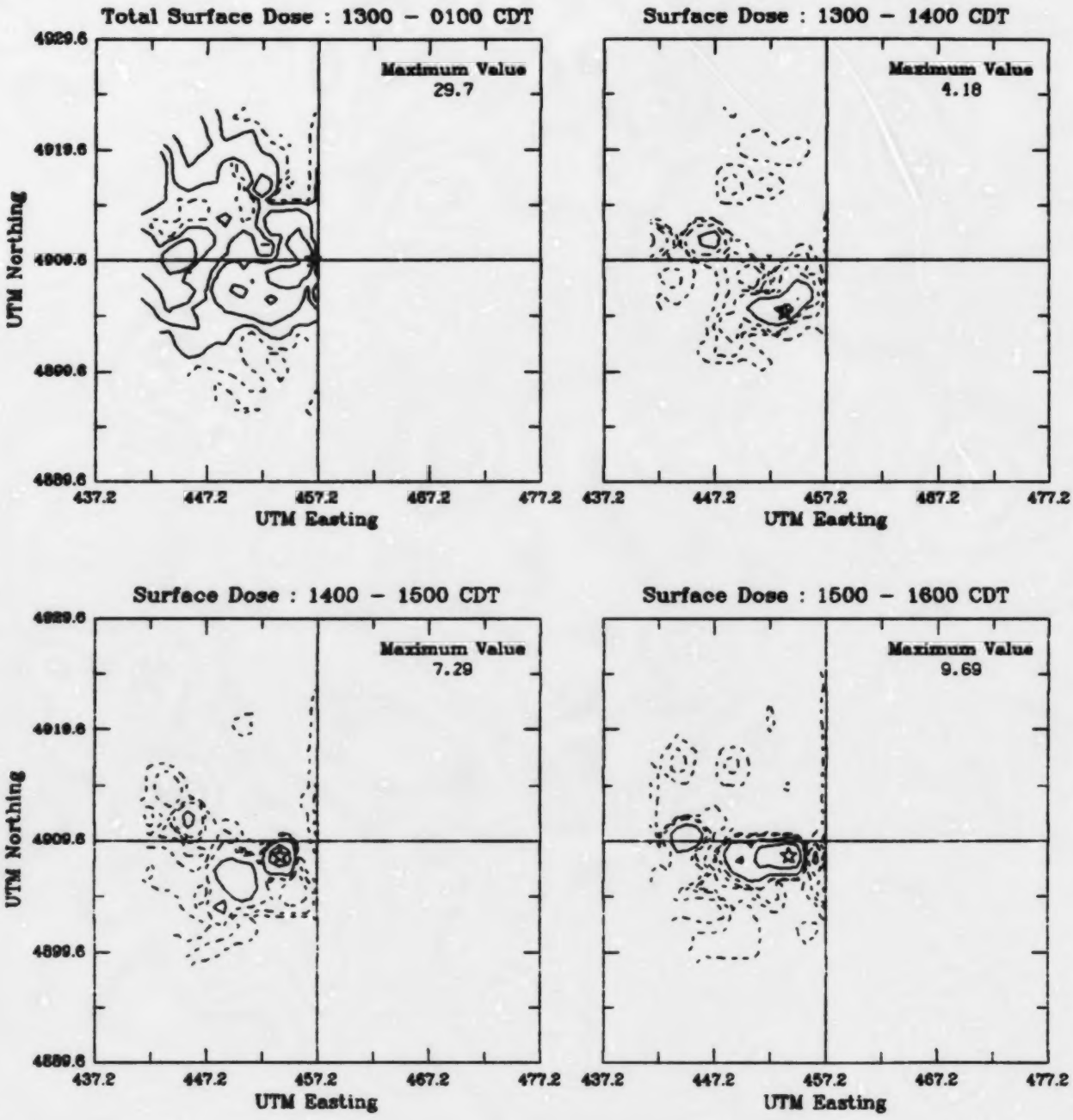
1982 SEADEX Field Experiment : Test 1 : May 28



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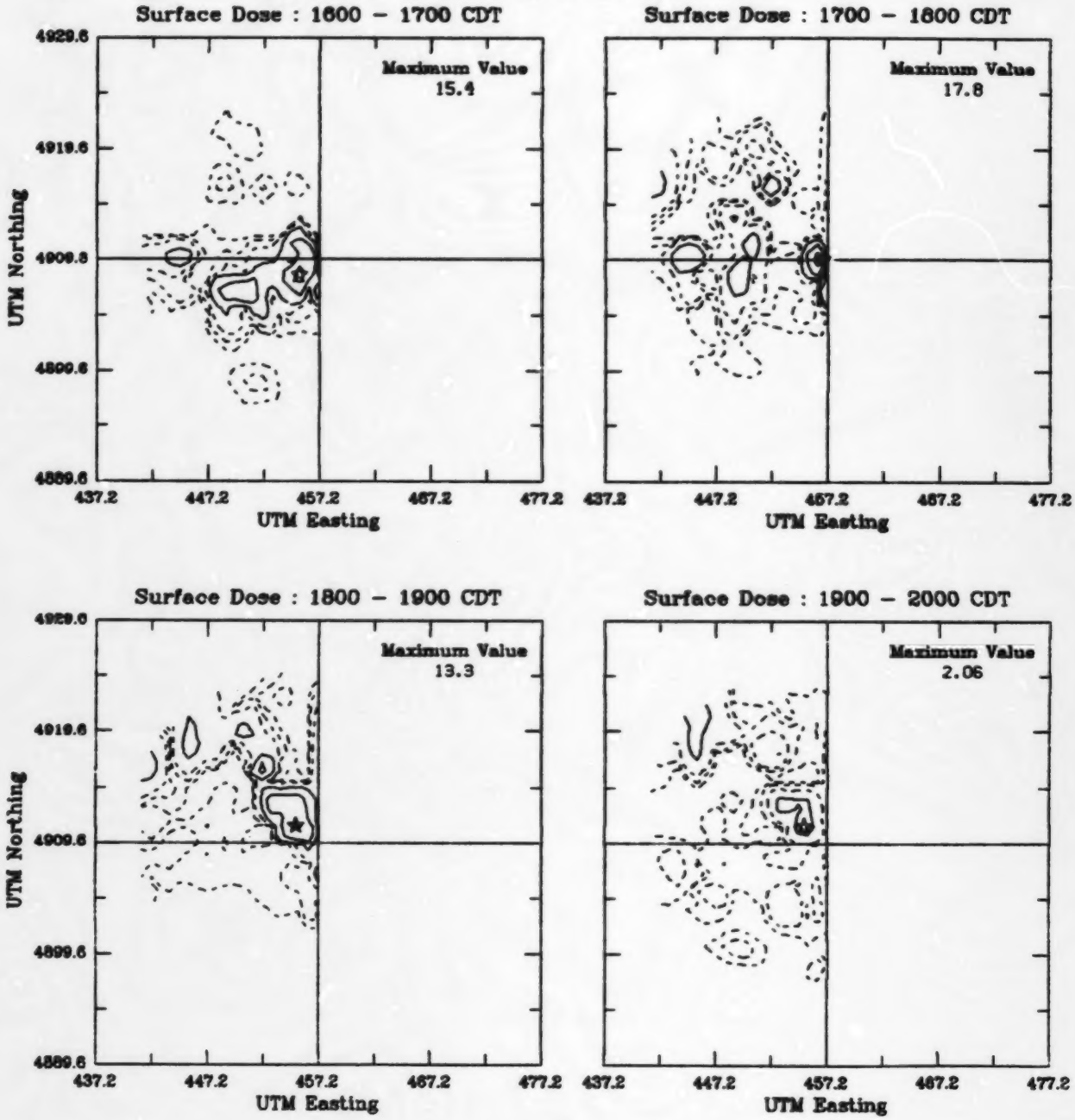

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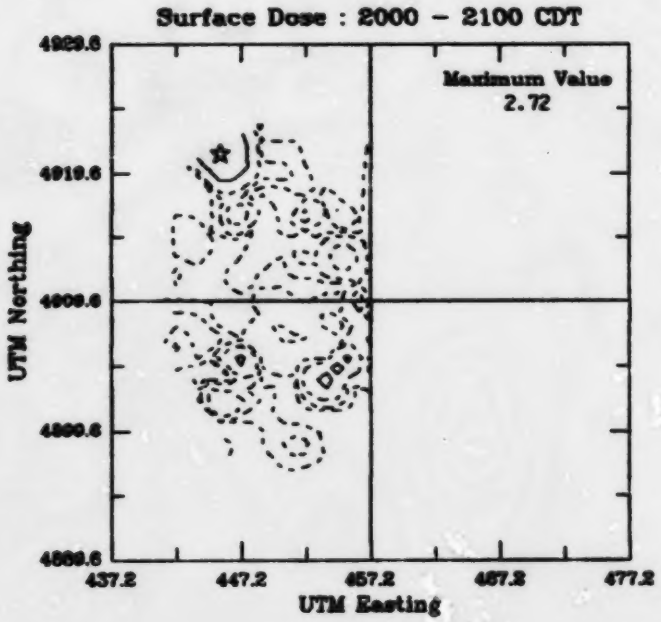

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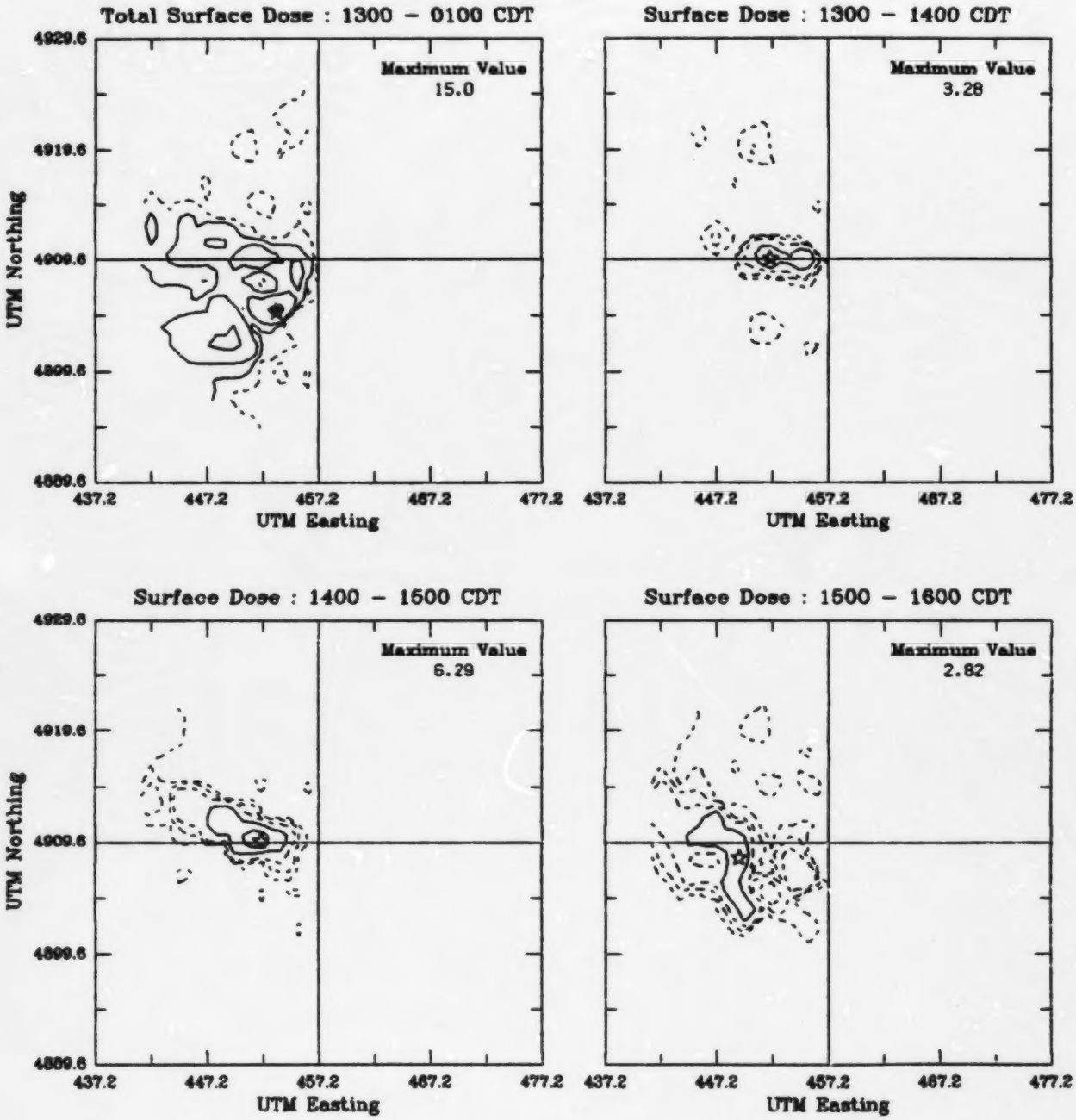
1982 SEADEX Field Experiment : Test 2 : May 29



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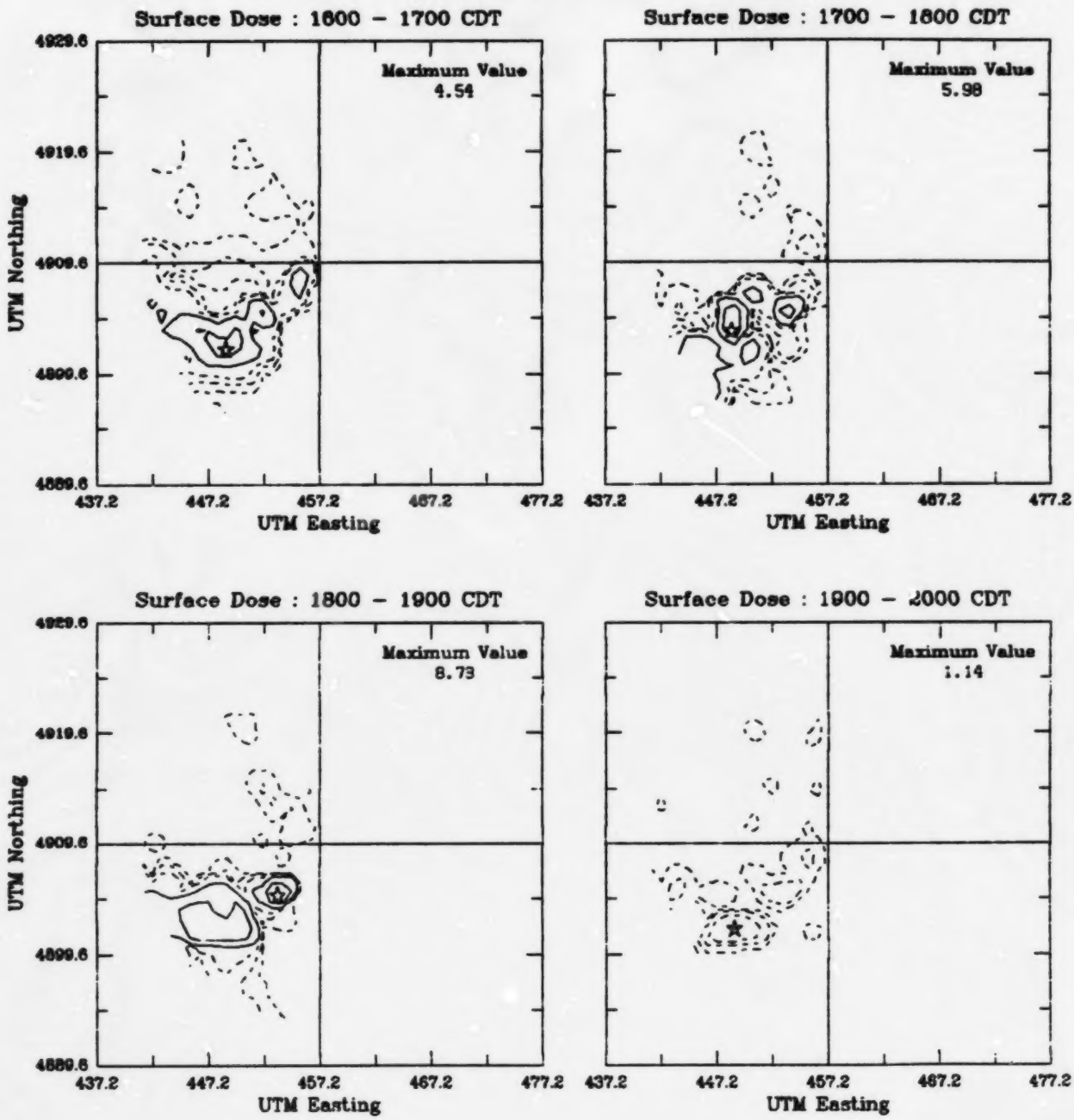

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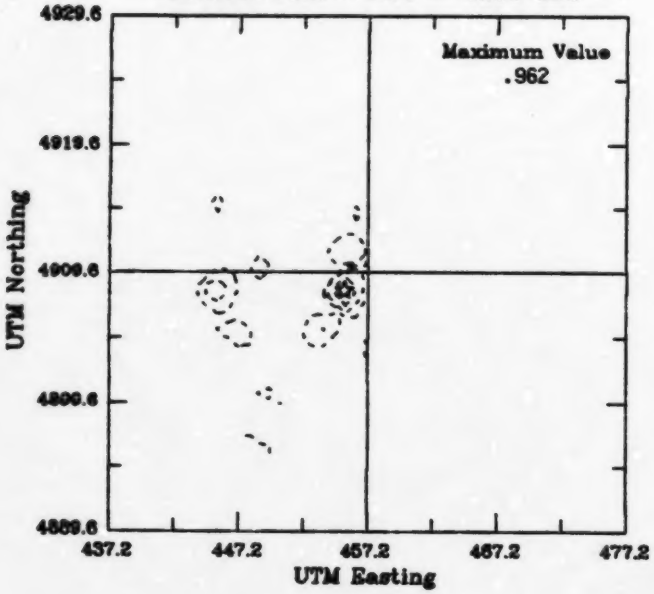
1982 SEADEX Field Experiment : Test 2 : May 29

Surface Dose : 2000 – 2100 CDT



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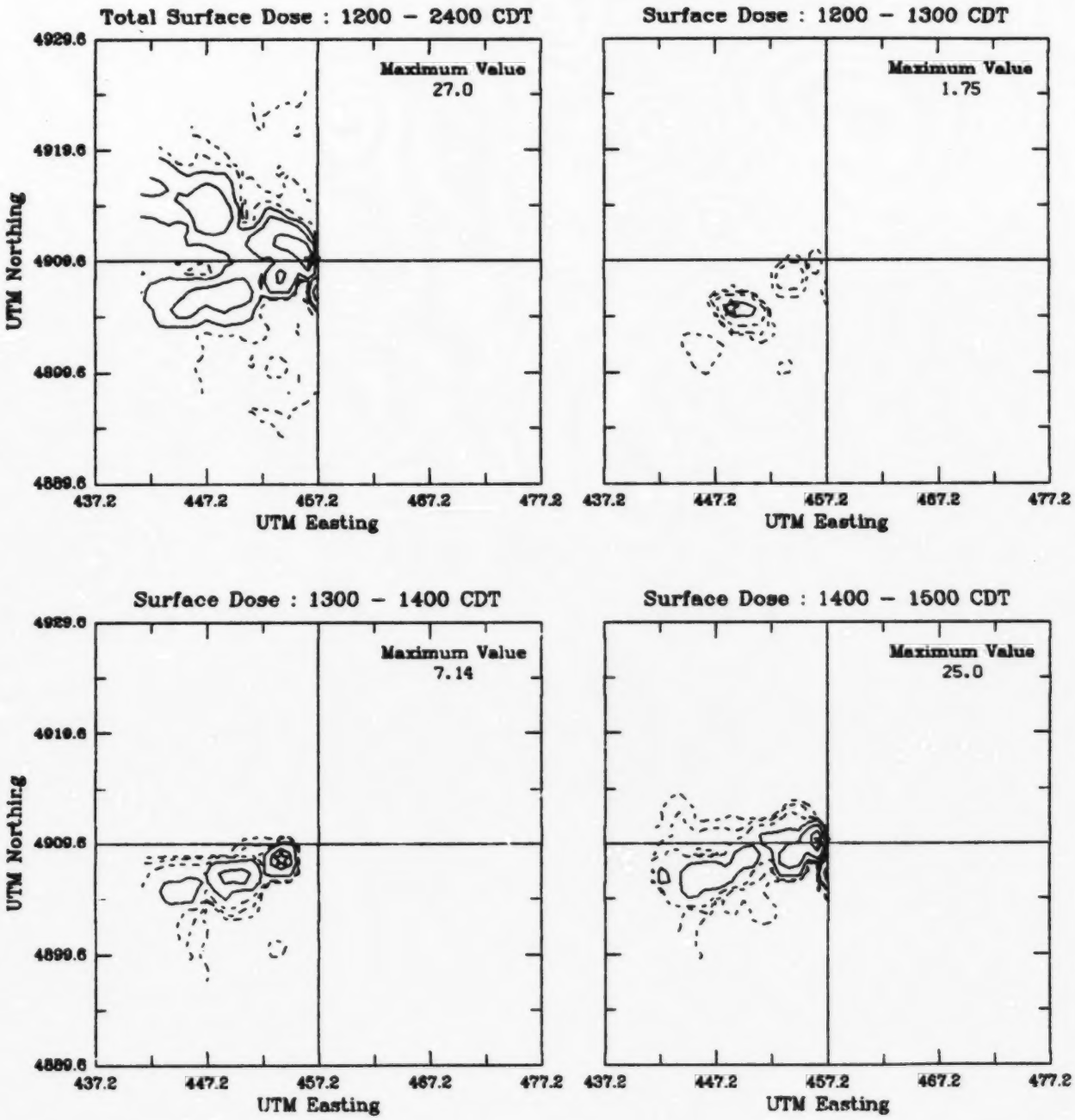
1982 SEADEX Field Experiment : Test 3 : May 30



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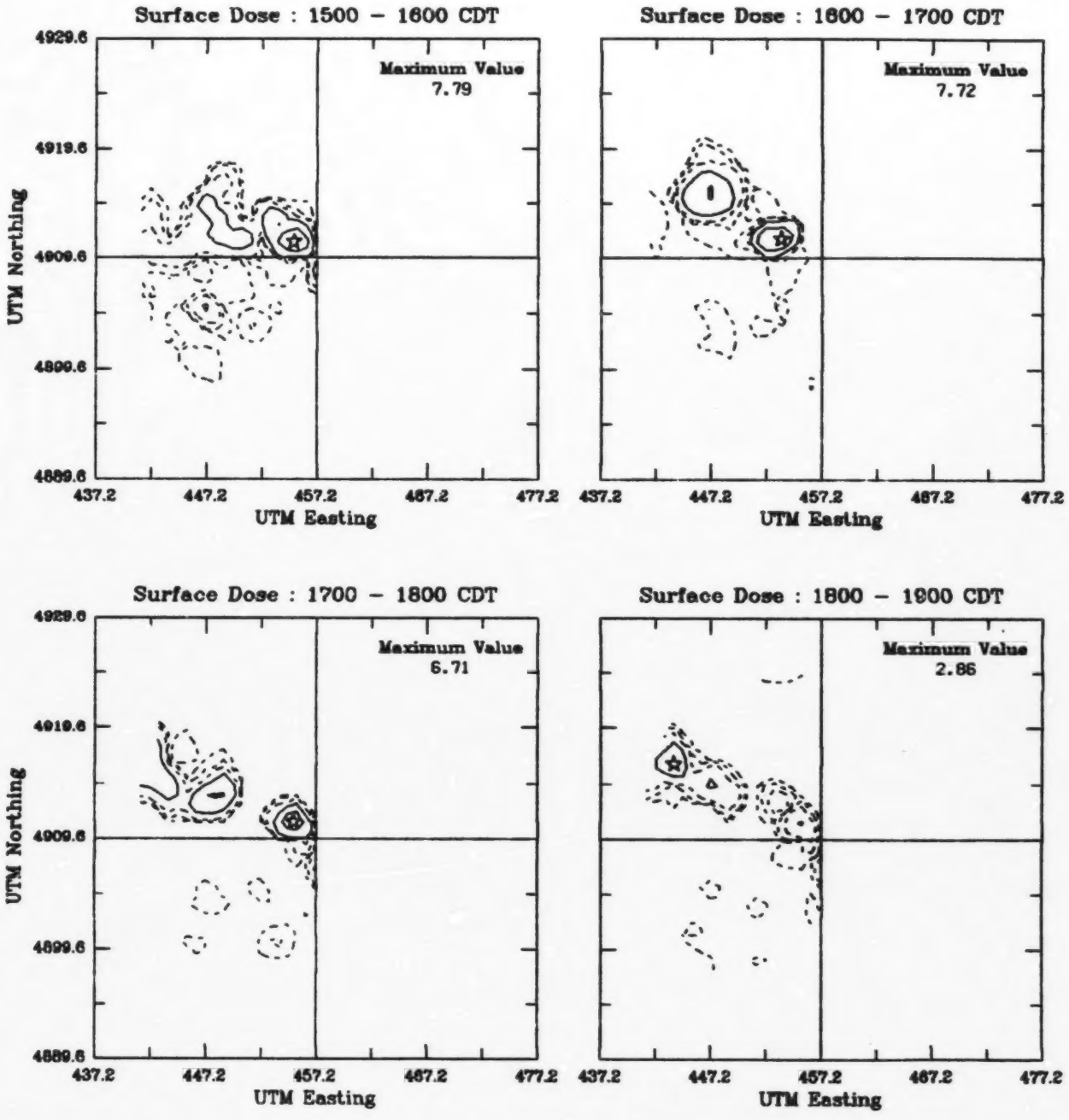

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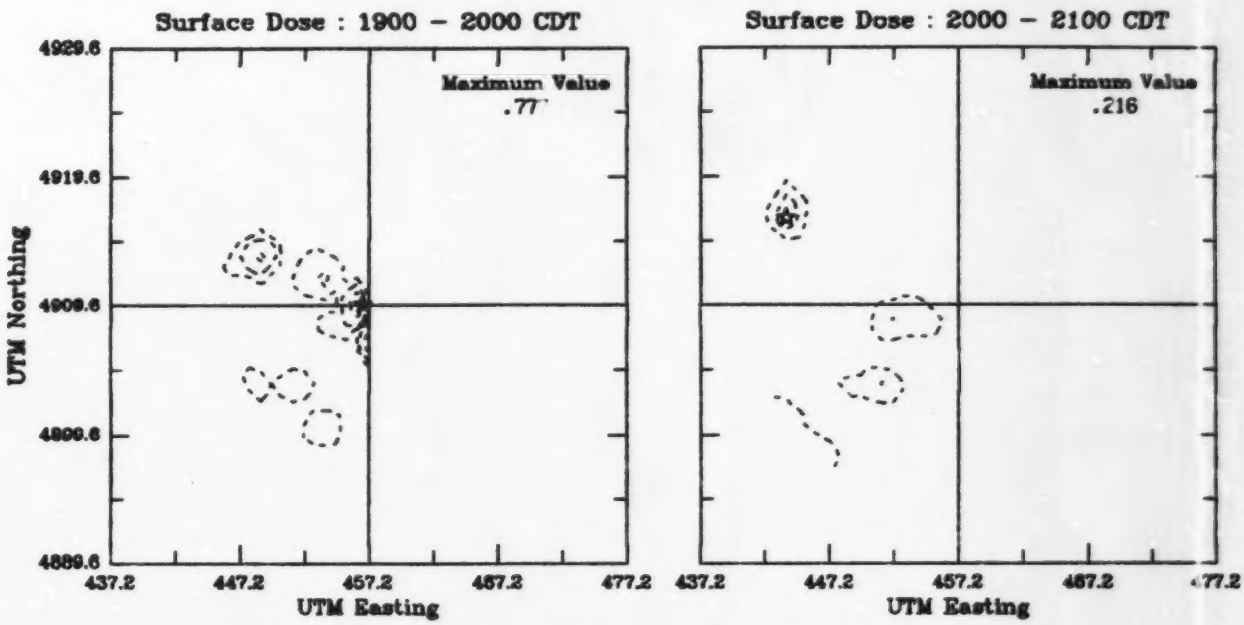

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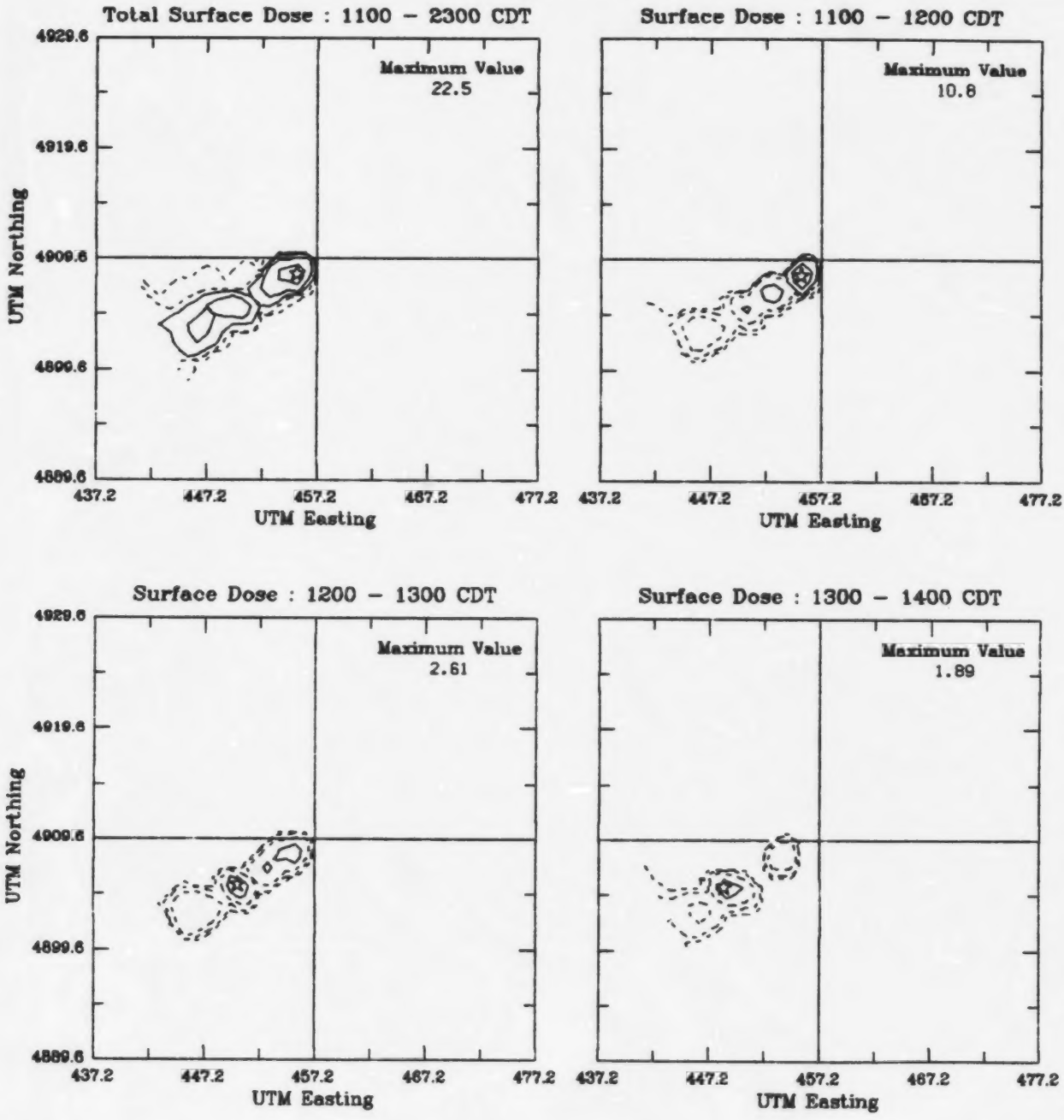

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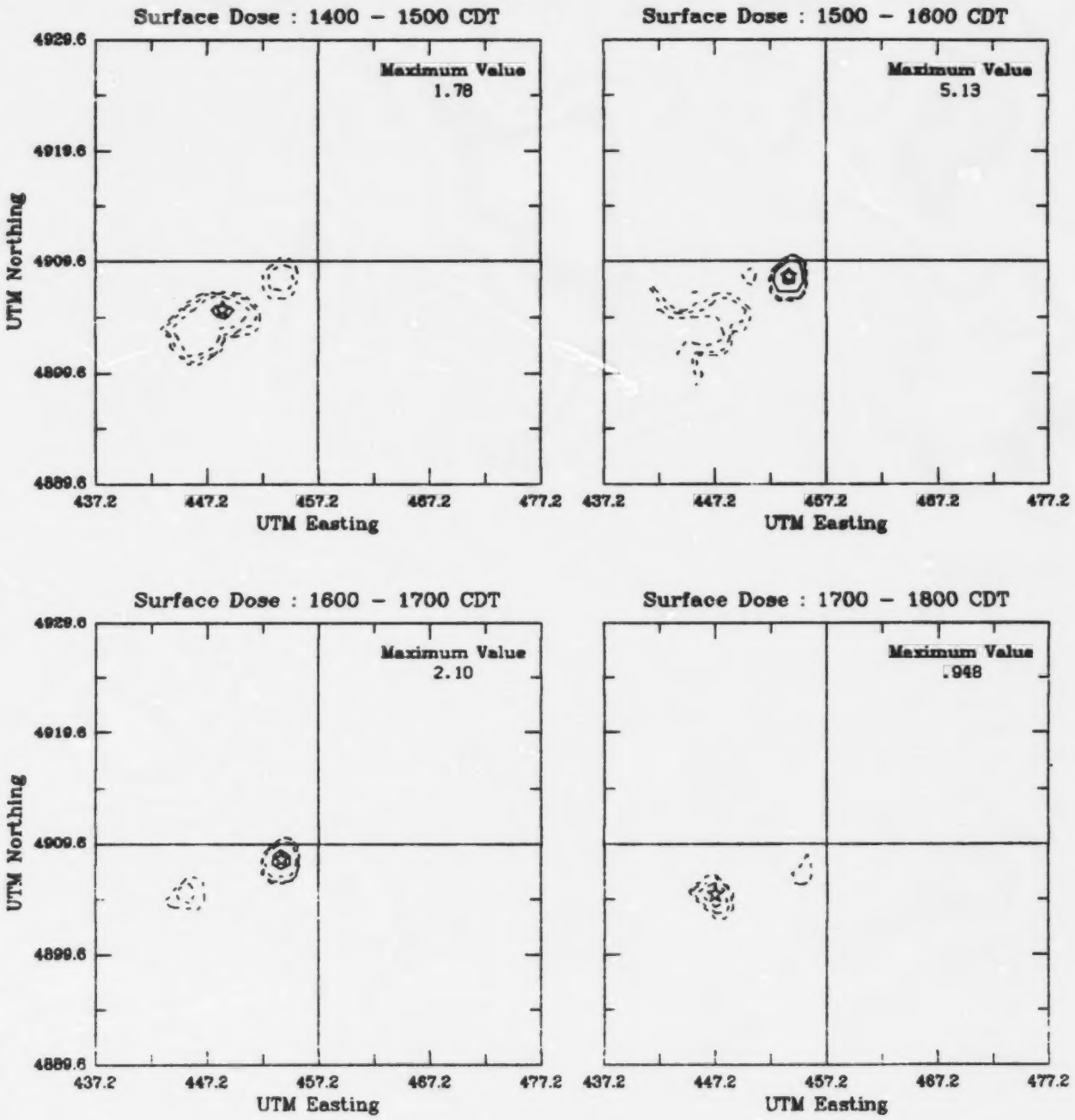

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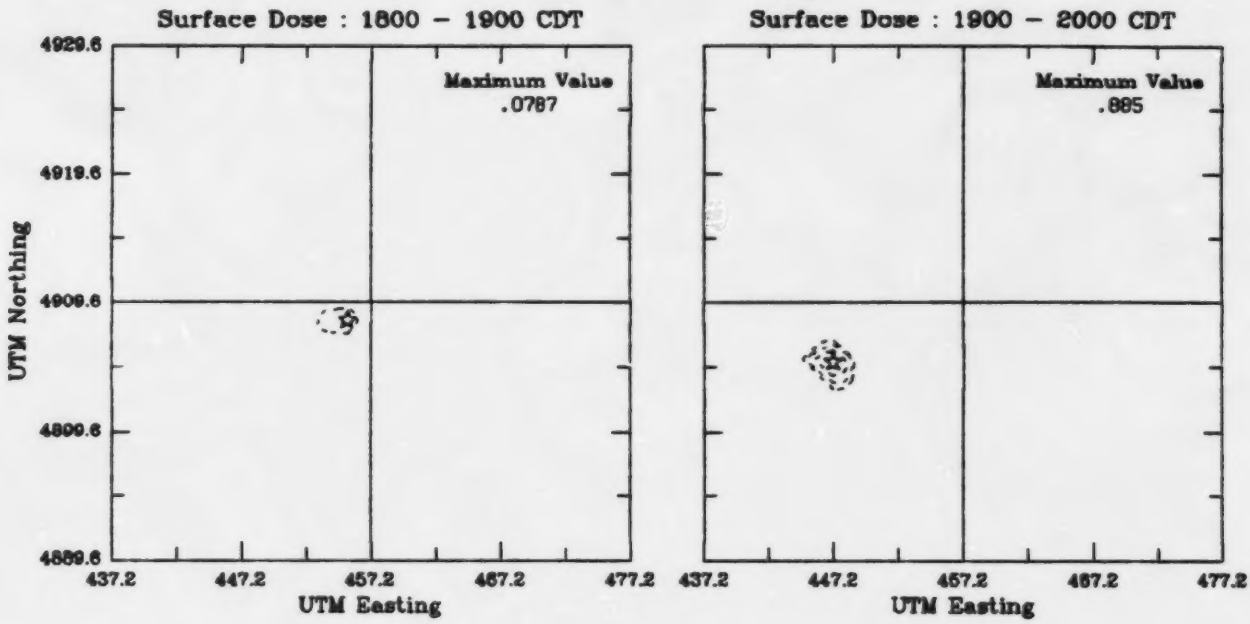

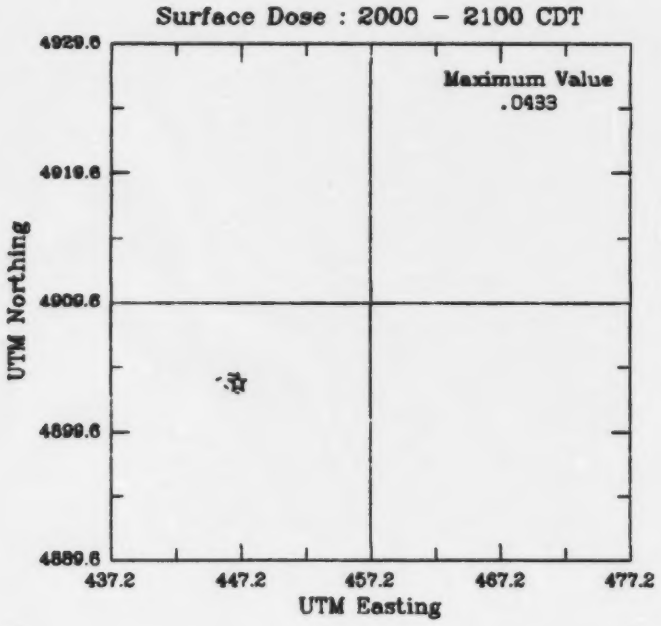

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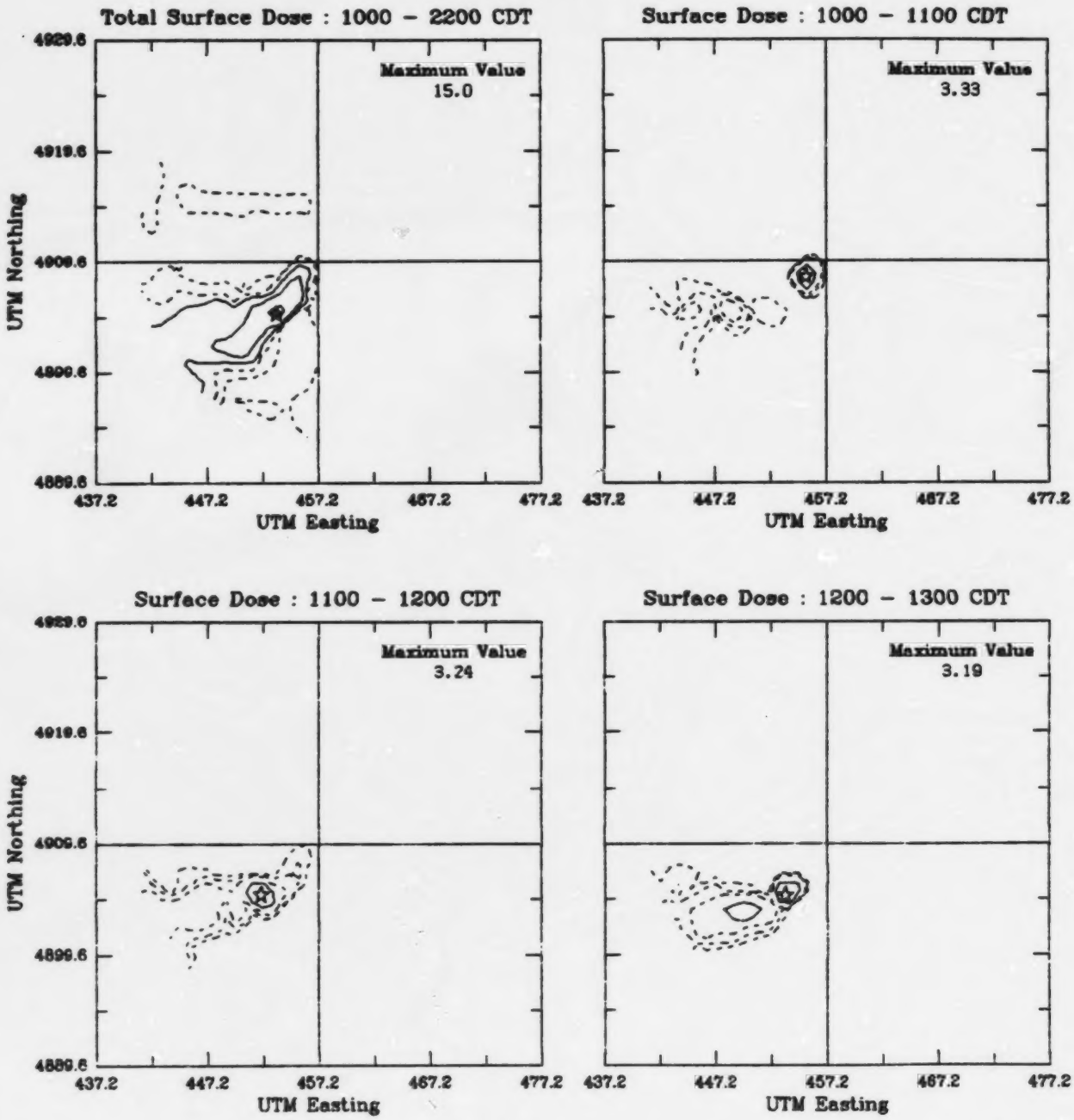
1982 SEADEX Field Experiment : Test 5 : June 03



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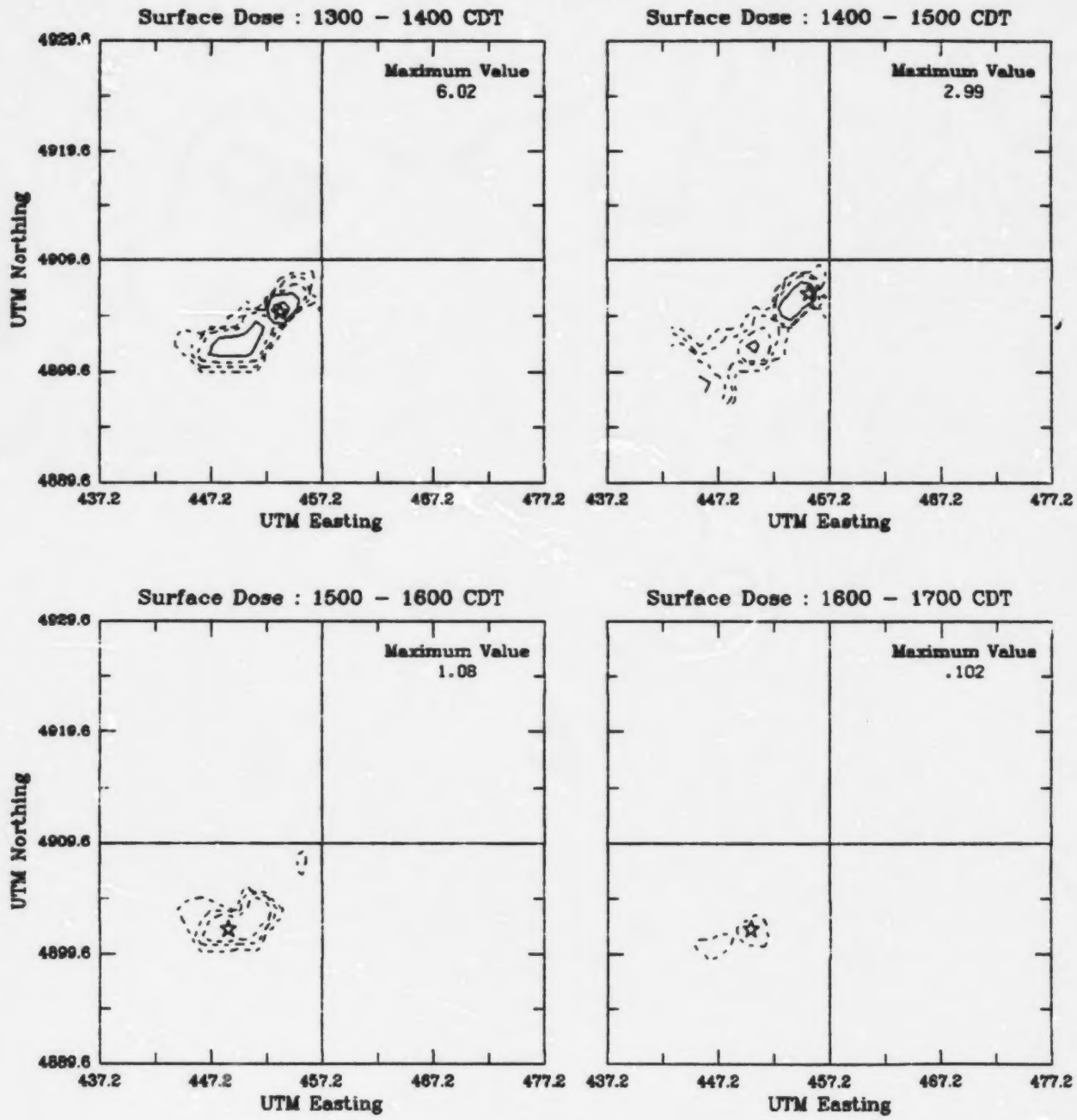

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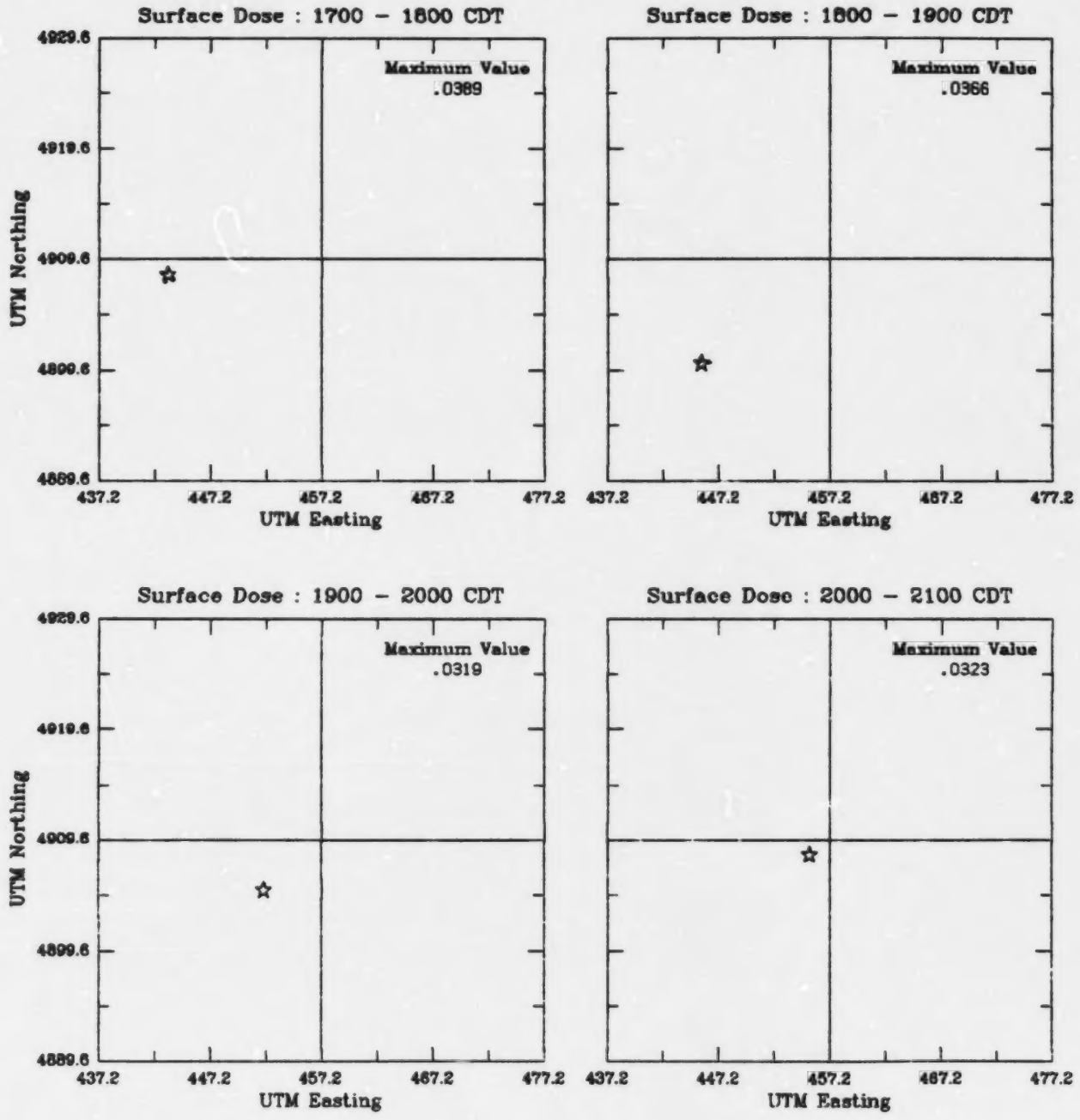

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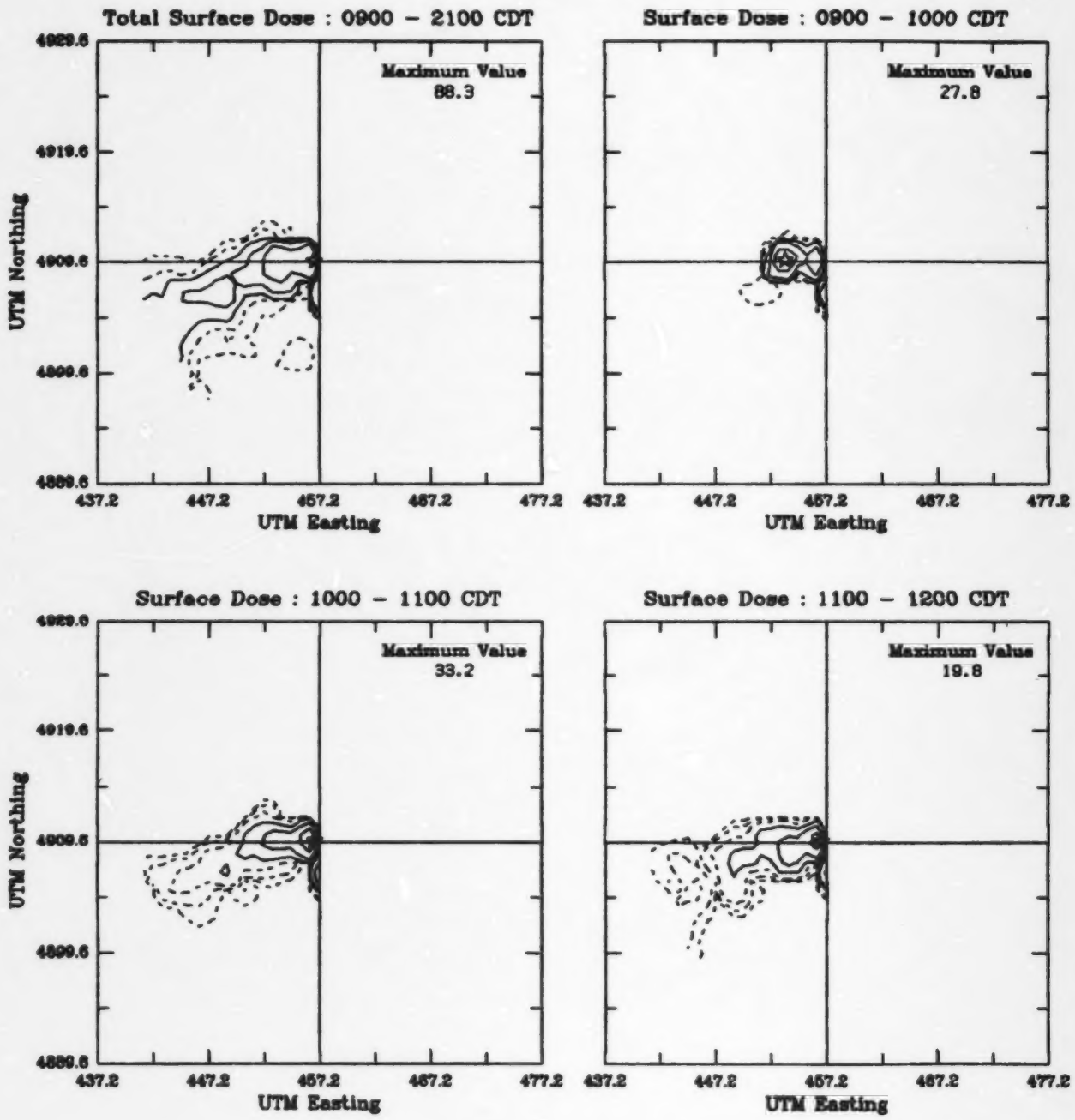
1982 SEADEX Field Experiment : Test 6 : June 04



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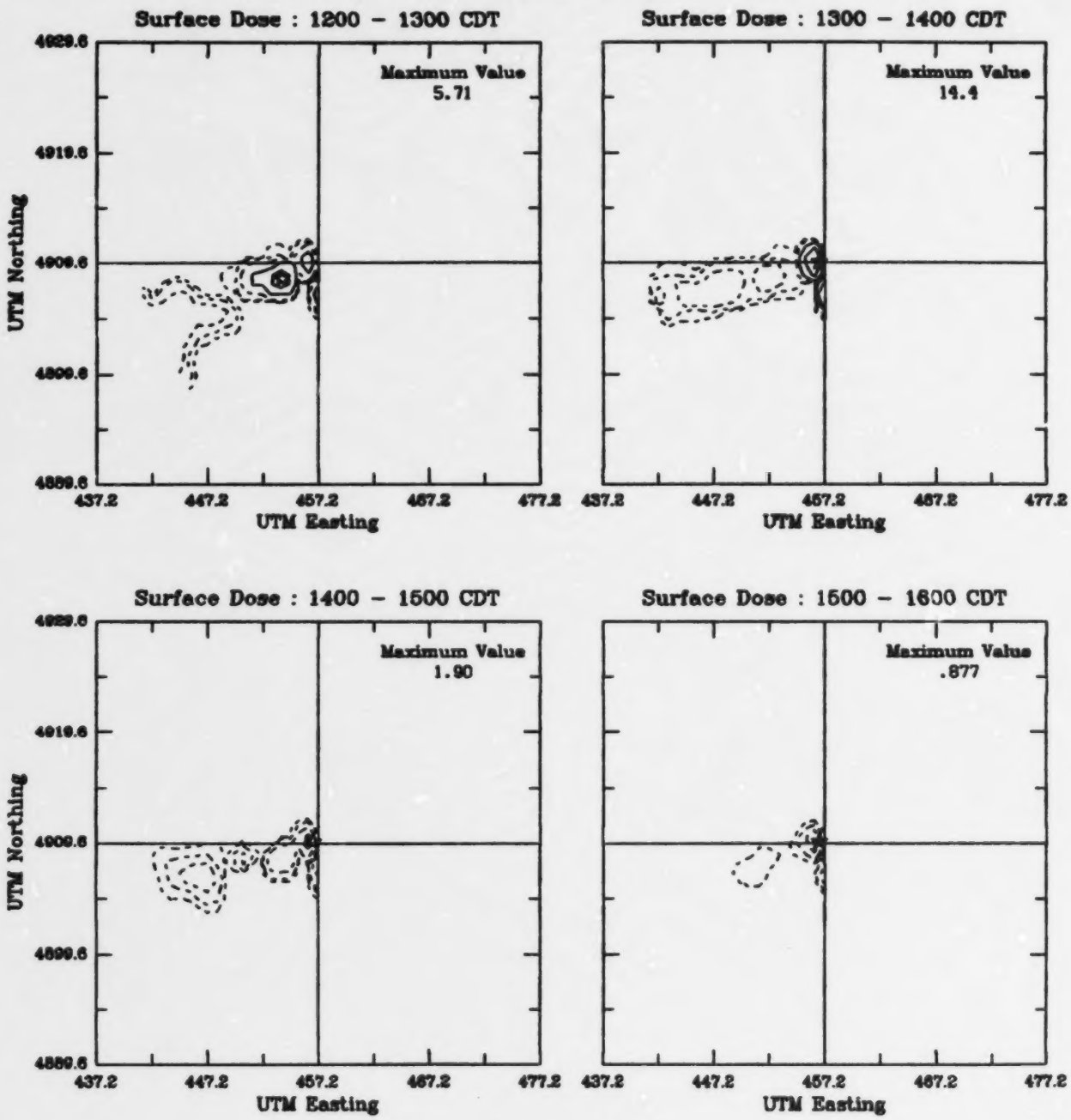
1982 SEADEX Field Experiment : Test 6 : June 04



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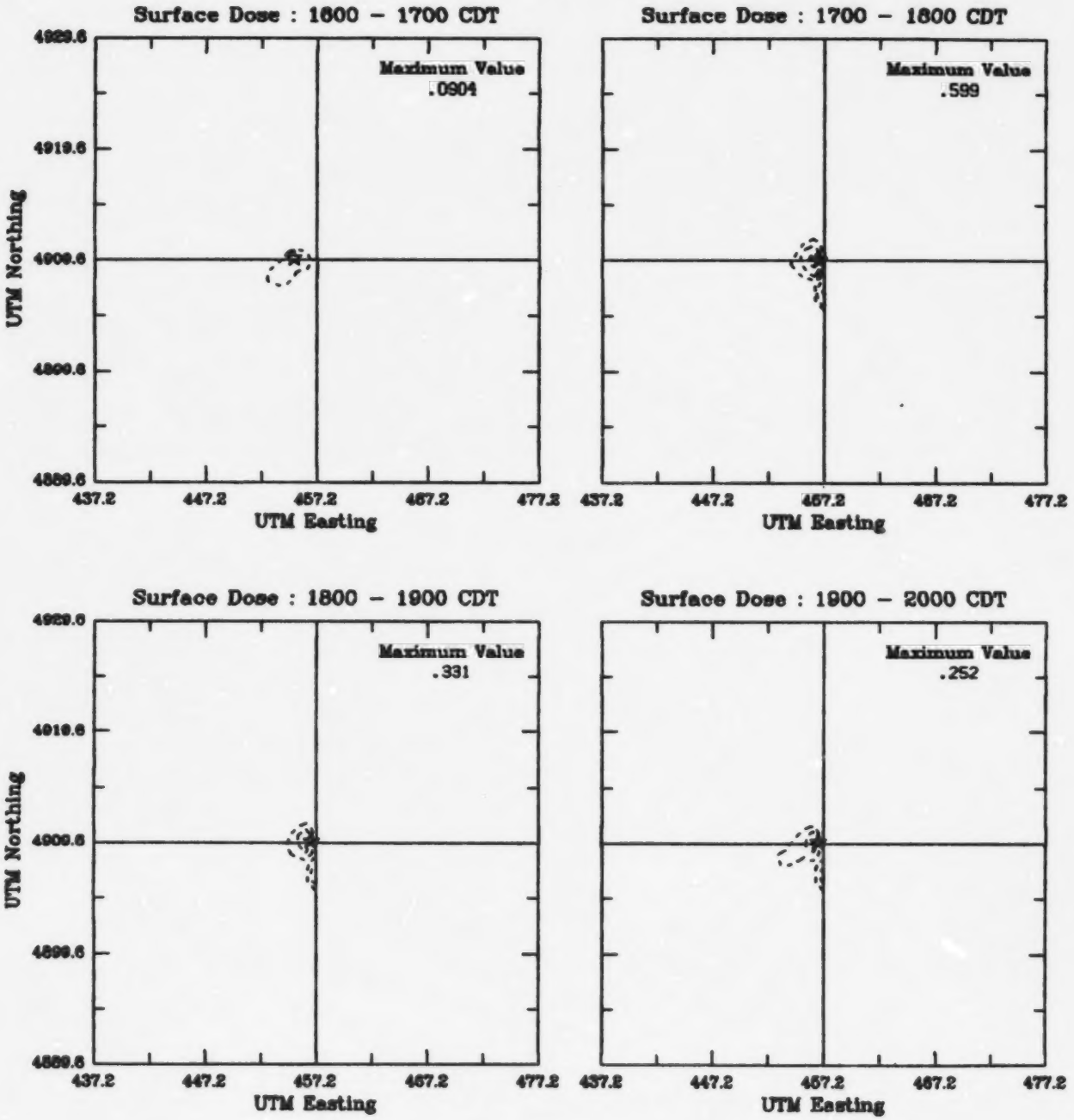
1982 SEADEX Field Experiment : Test 6 : June 04



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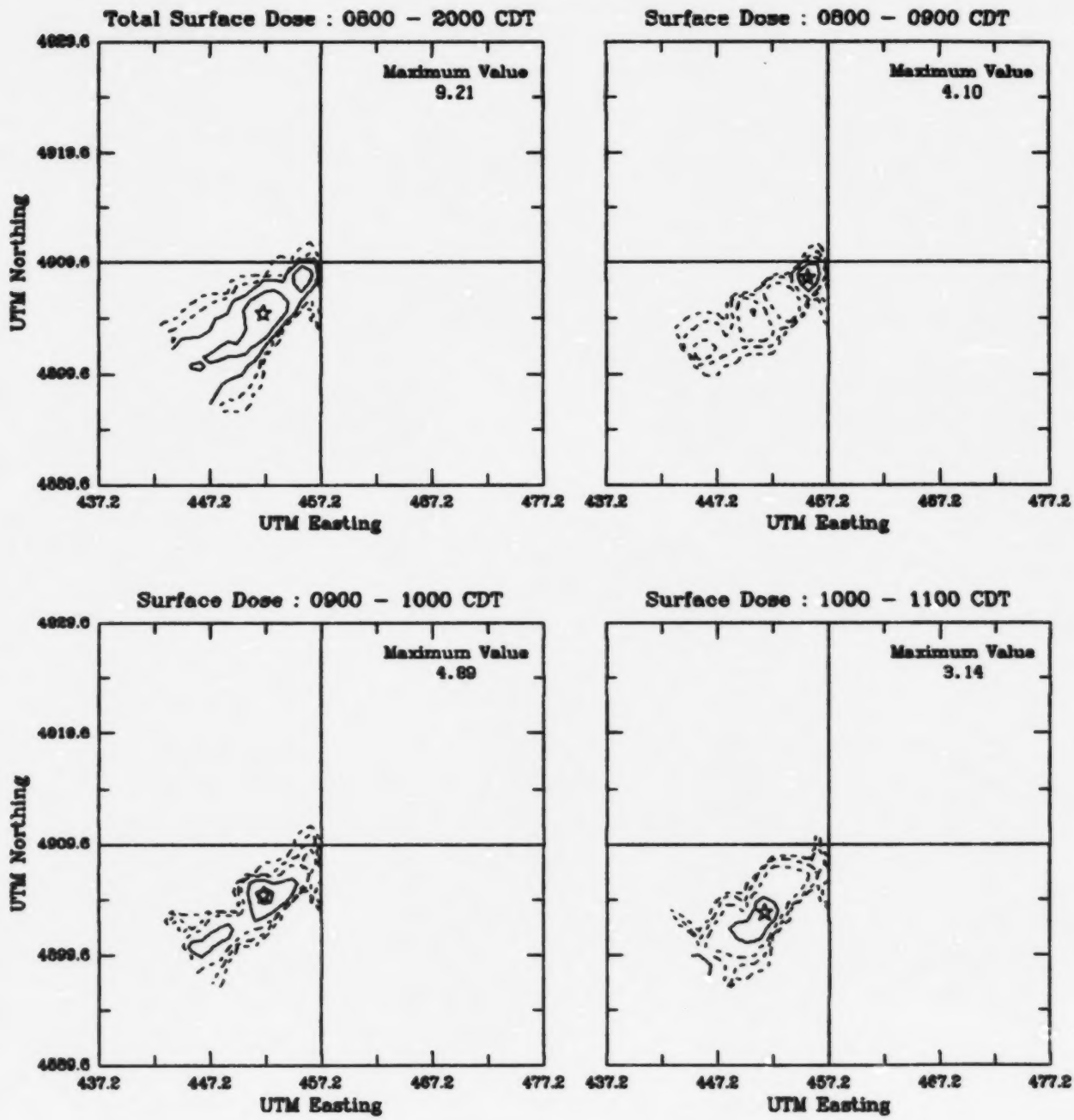
1982 SEADEX Field Experiment : Test 7 : June 05



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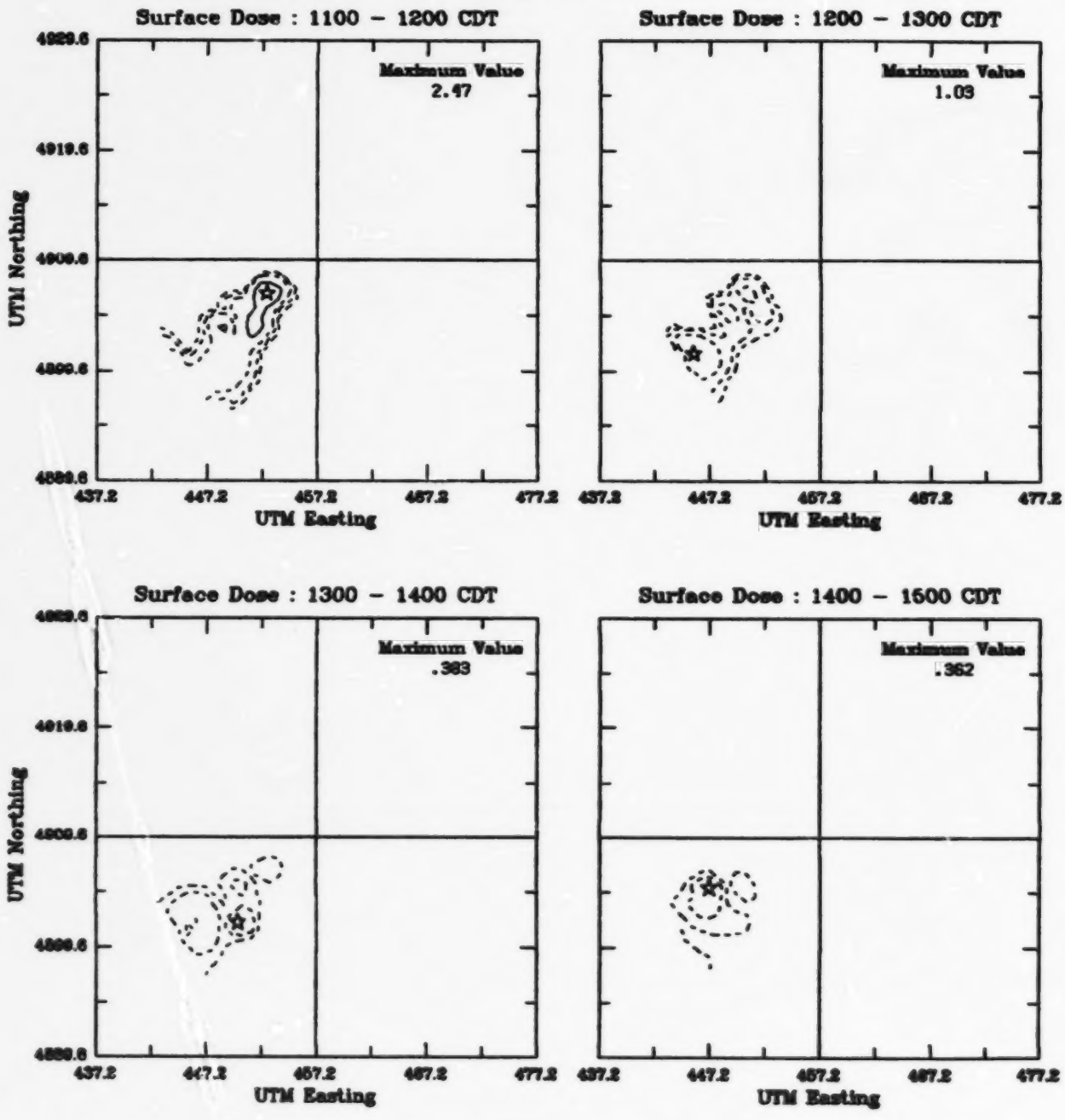

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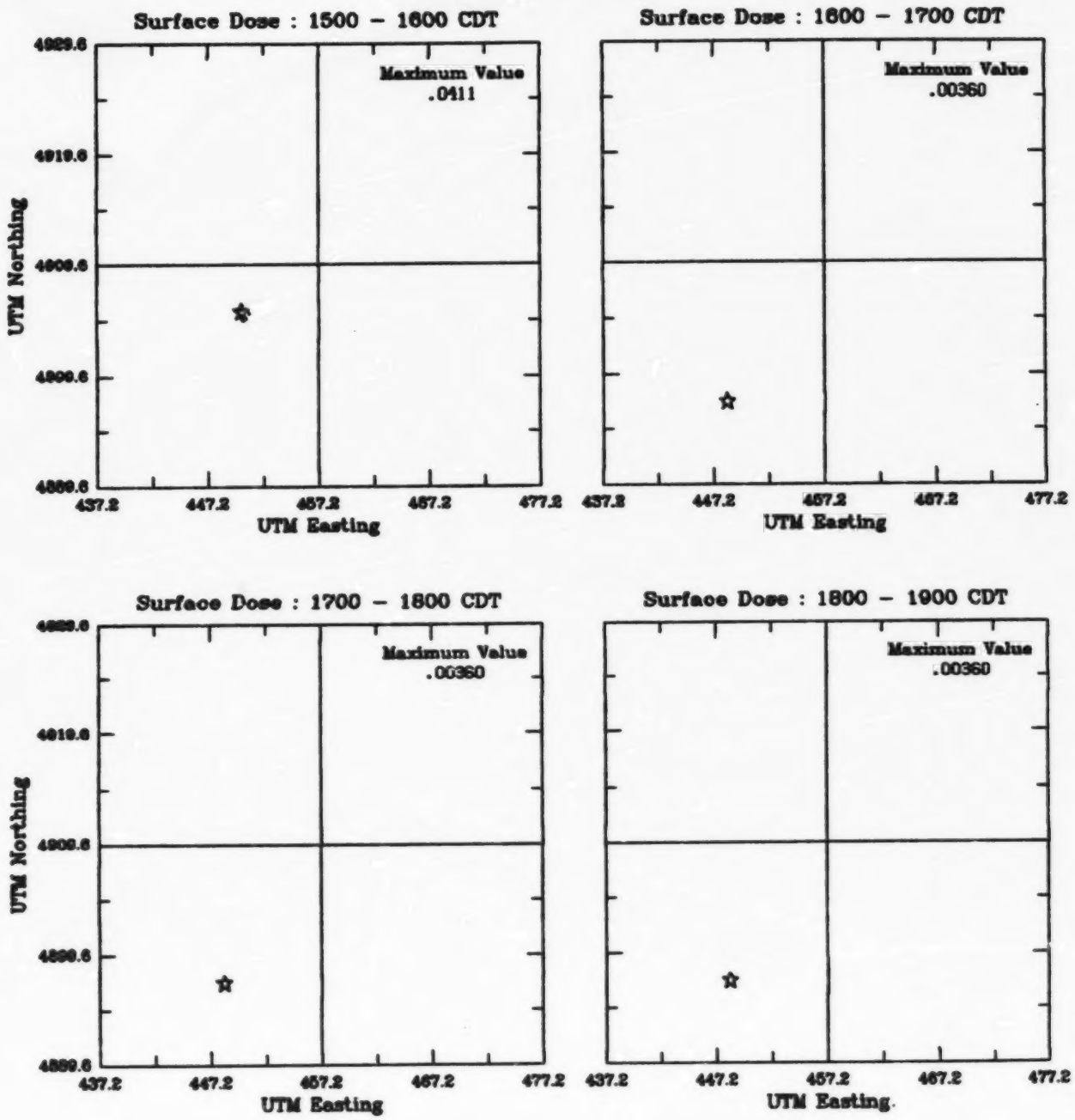

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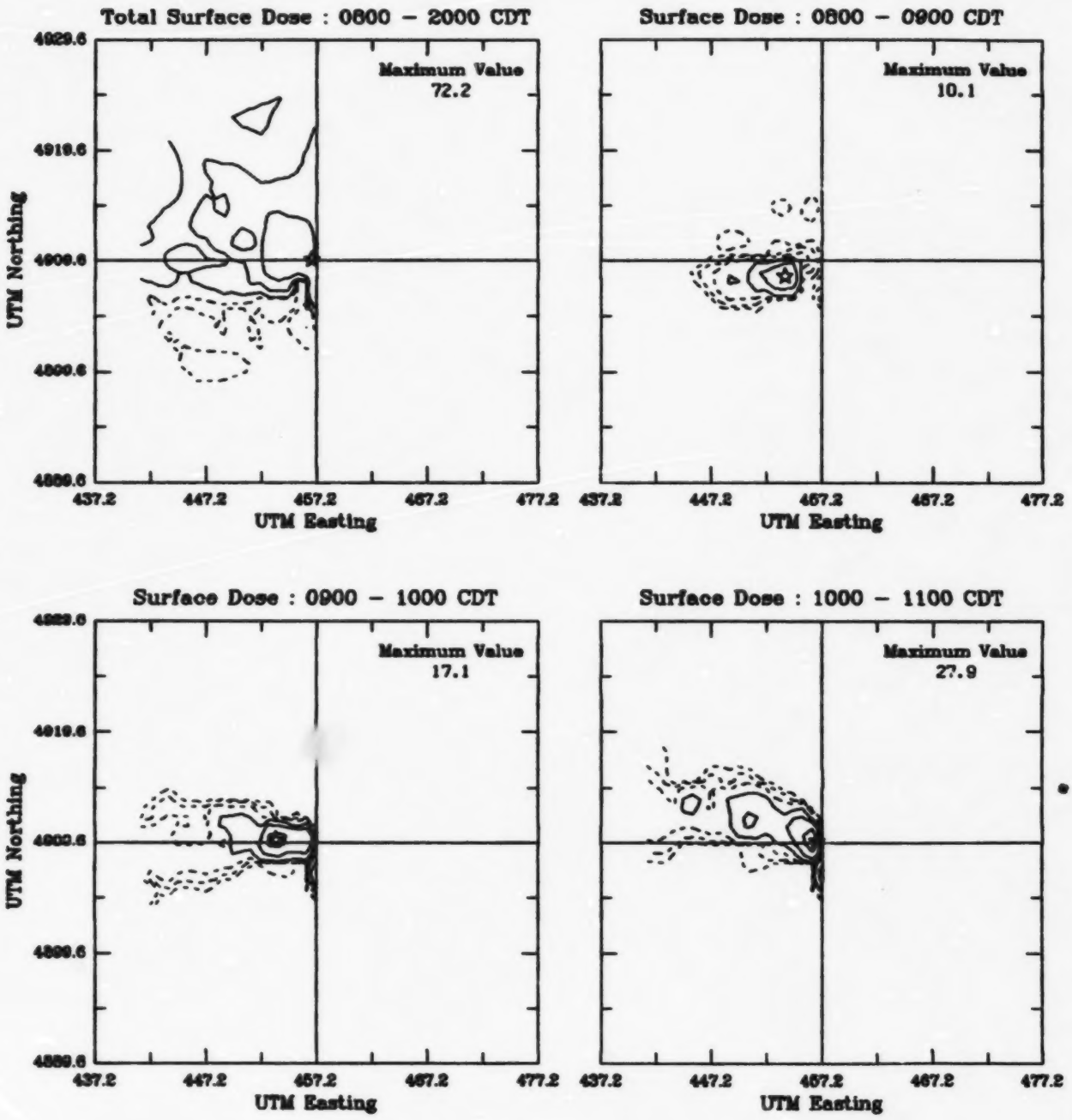
1982 SEADEX Field Experiment : Test 8 : June 06



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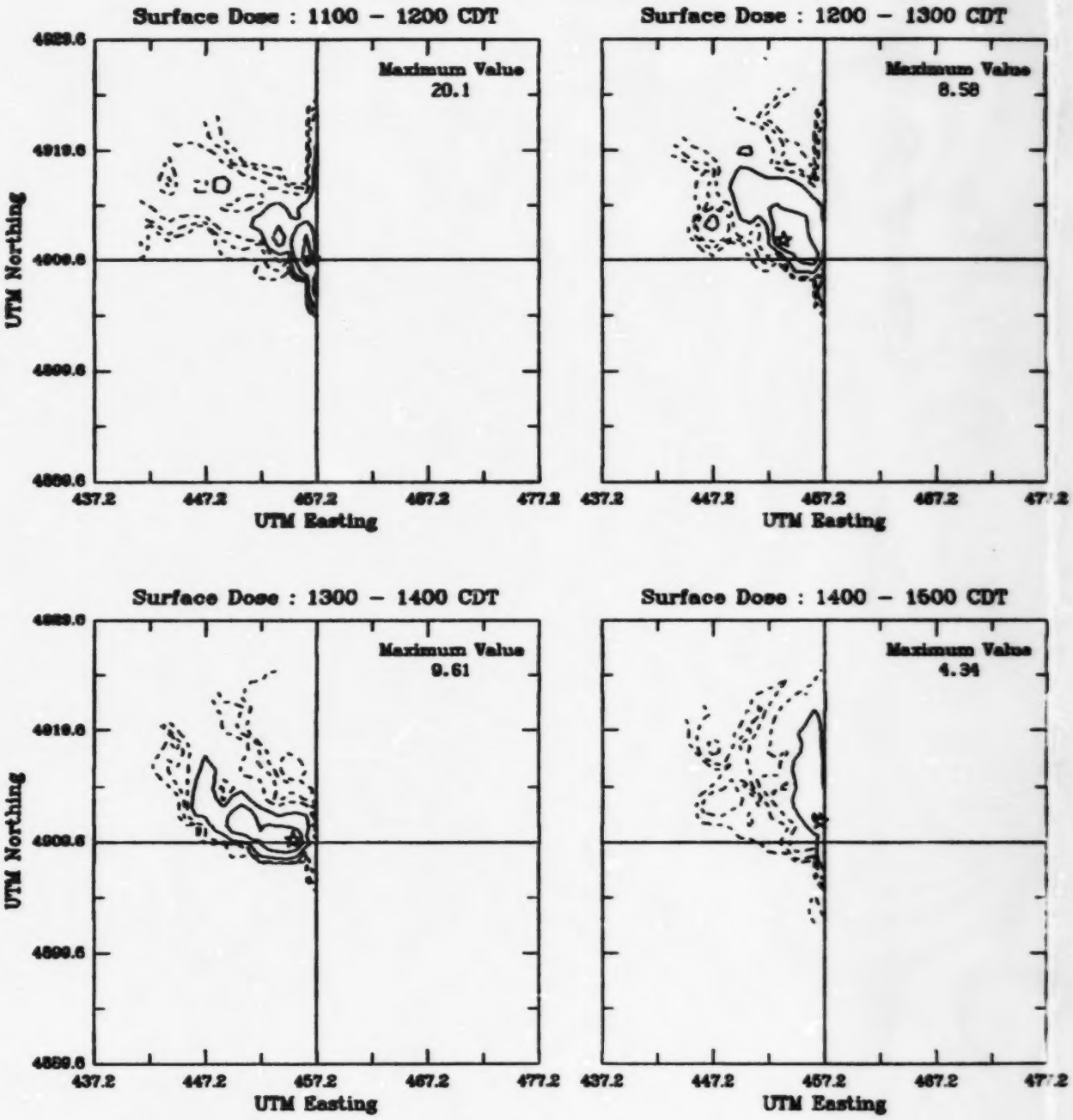

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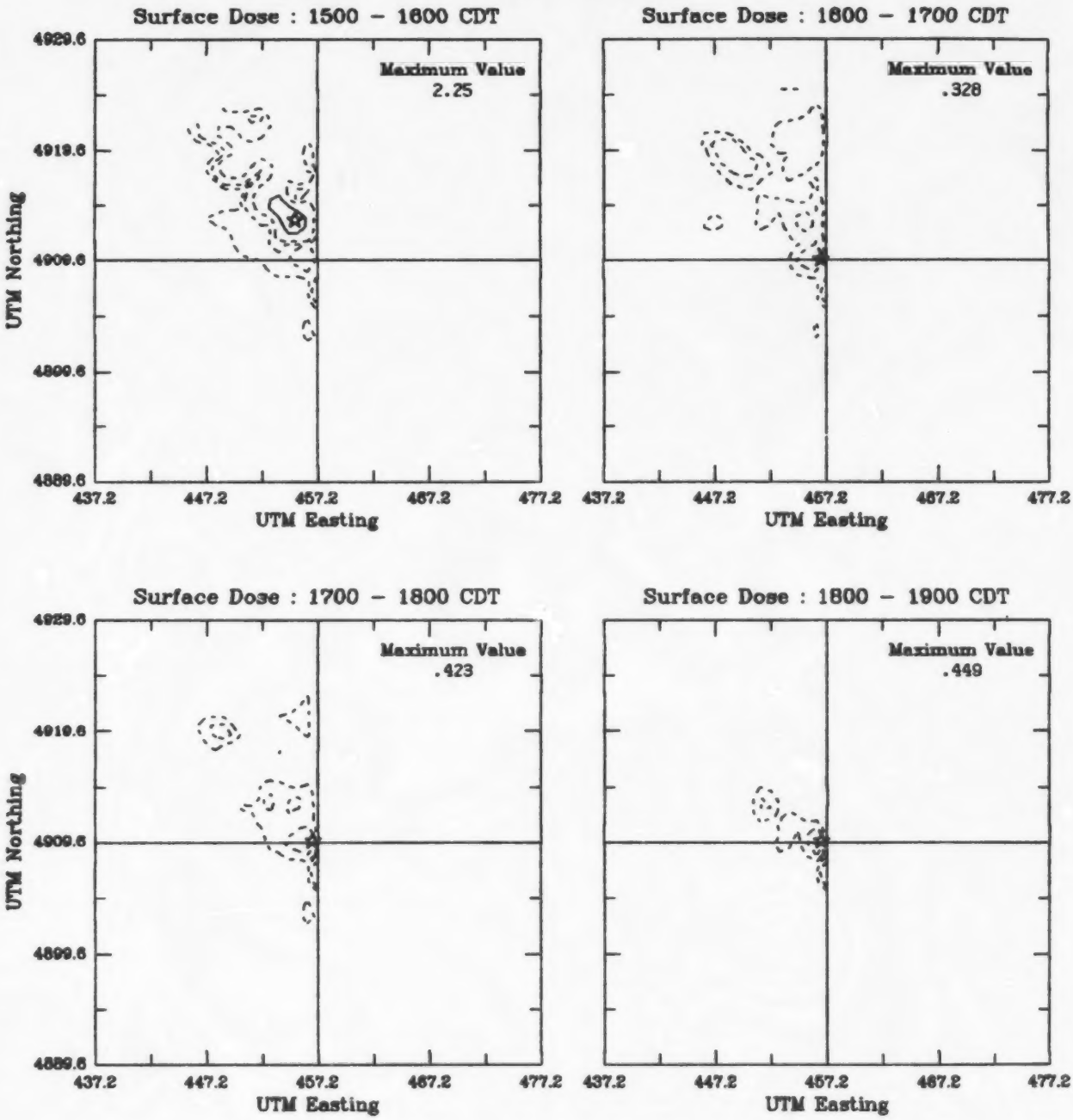

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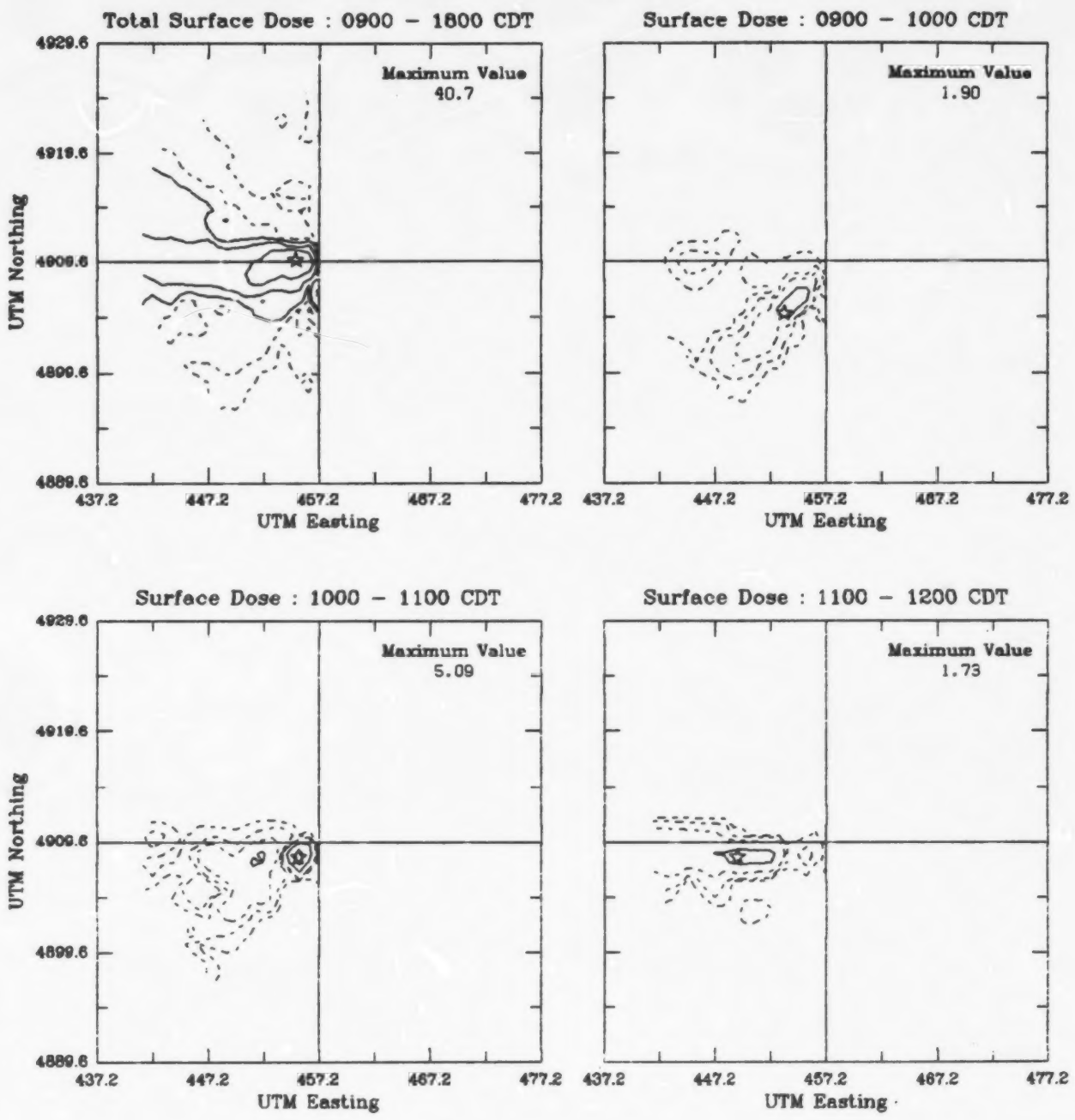
1982 SEADEX Field Experiment : Test 9 : June 08



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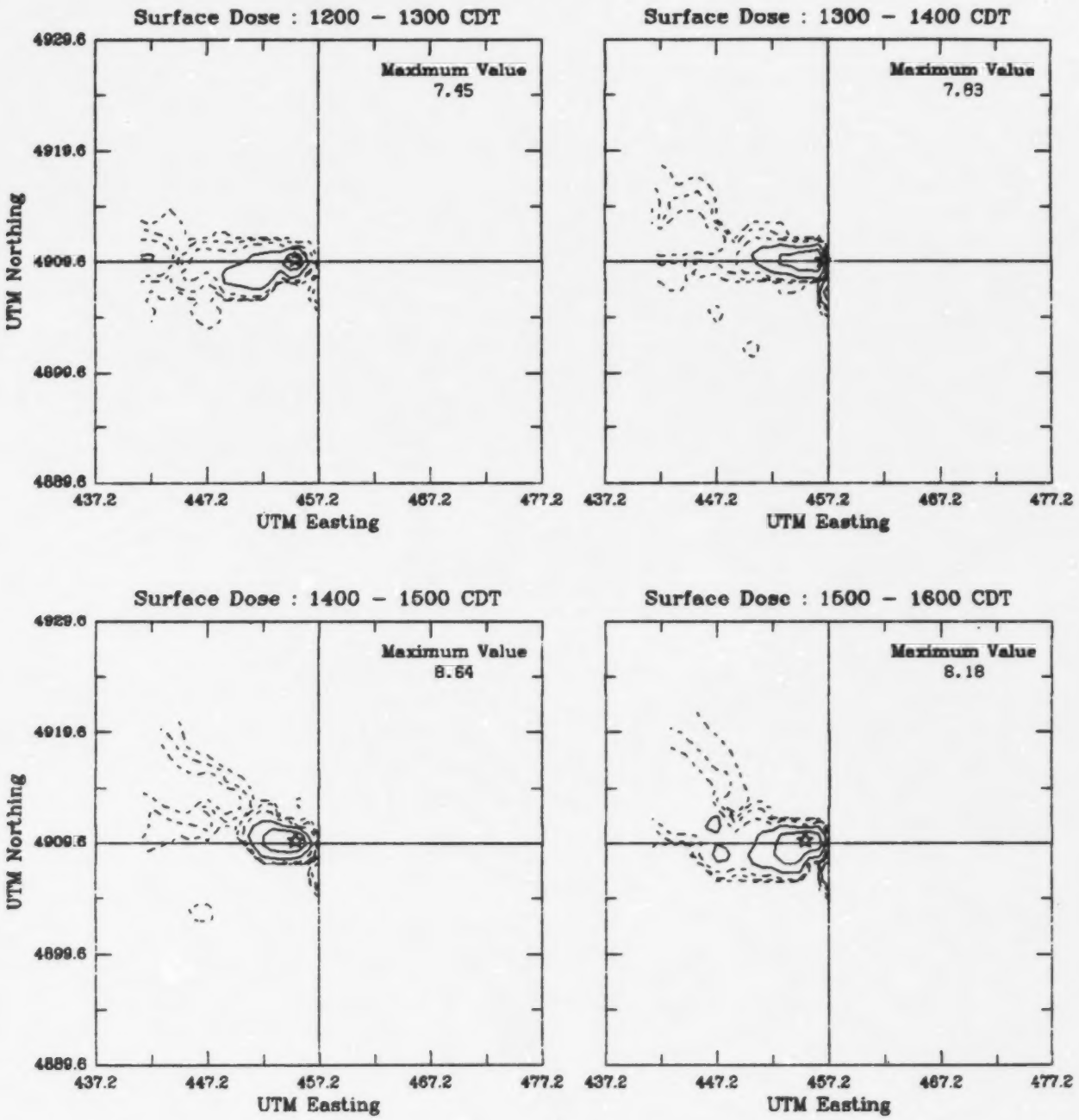

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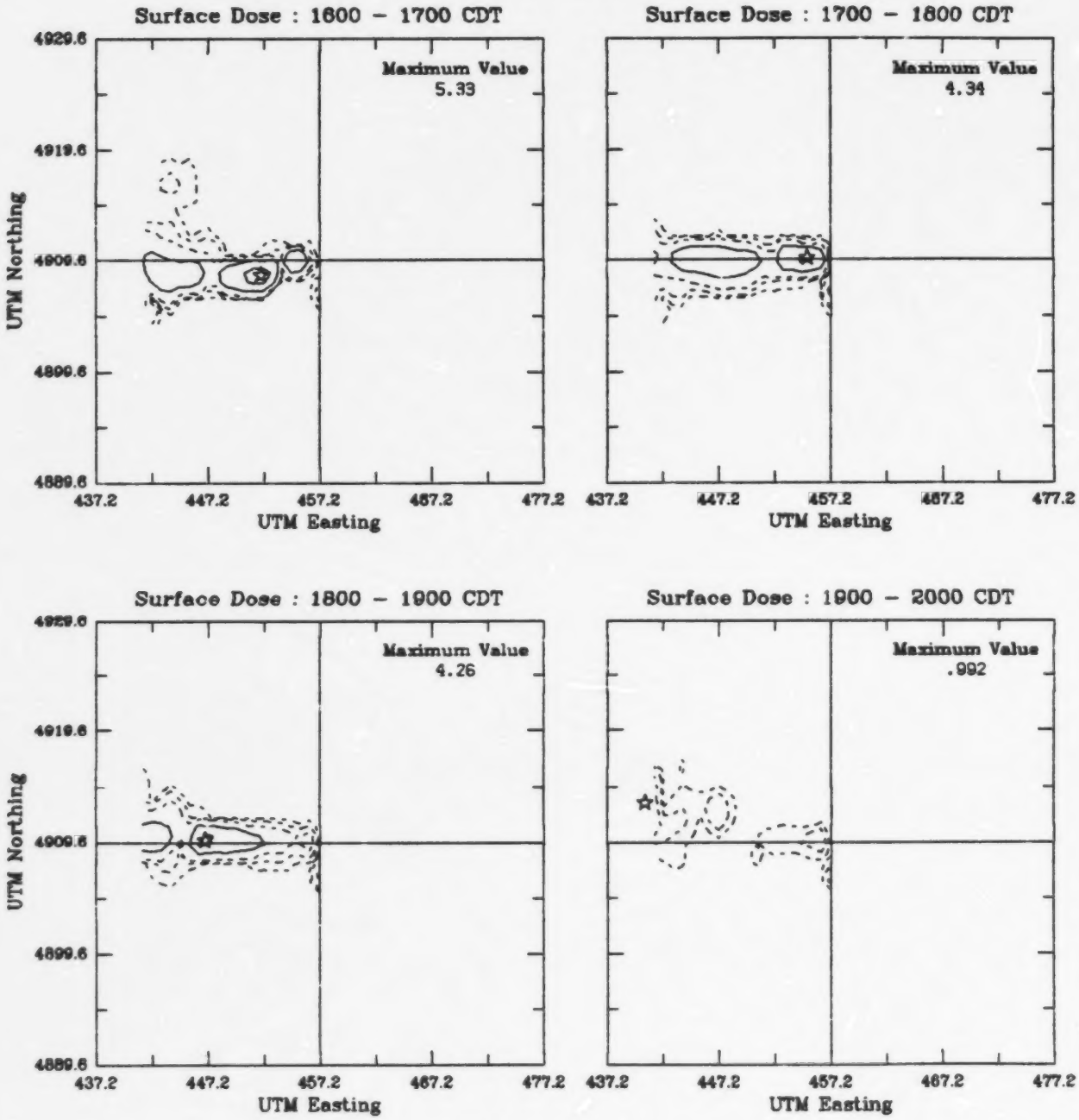

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Appendix B

Model Simulation of Surface Doses

The total dose and example hourly doses, for hours 1,3 and 5, are shown for each model for each test. Where a particular test number is missing for a particular model, some input data required for that model was missing. The models are presented in the same order as discussed in Section III; the steady-state models first, the gaussian puff models second, and the transport and diffusion models.

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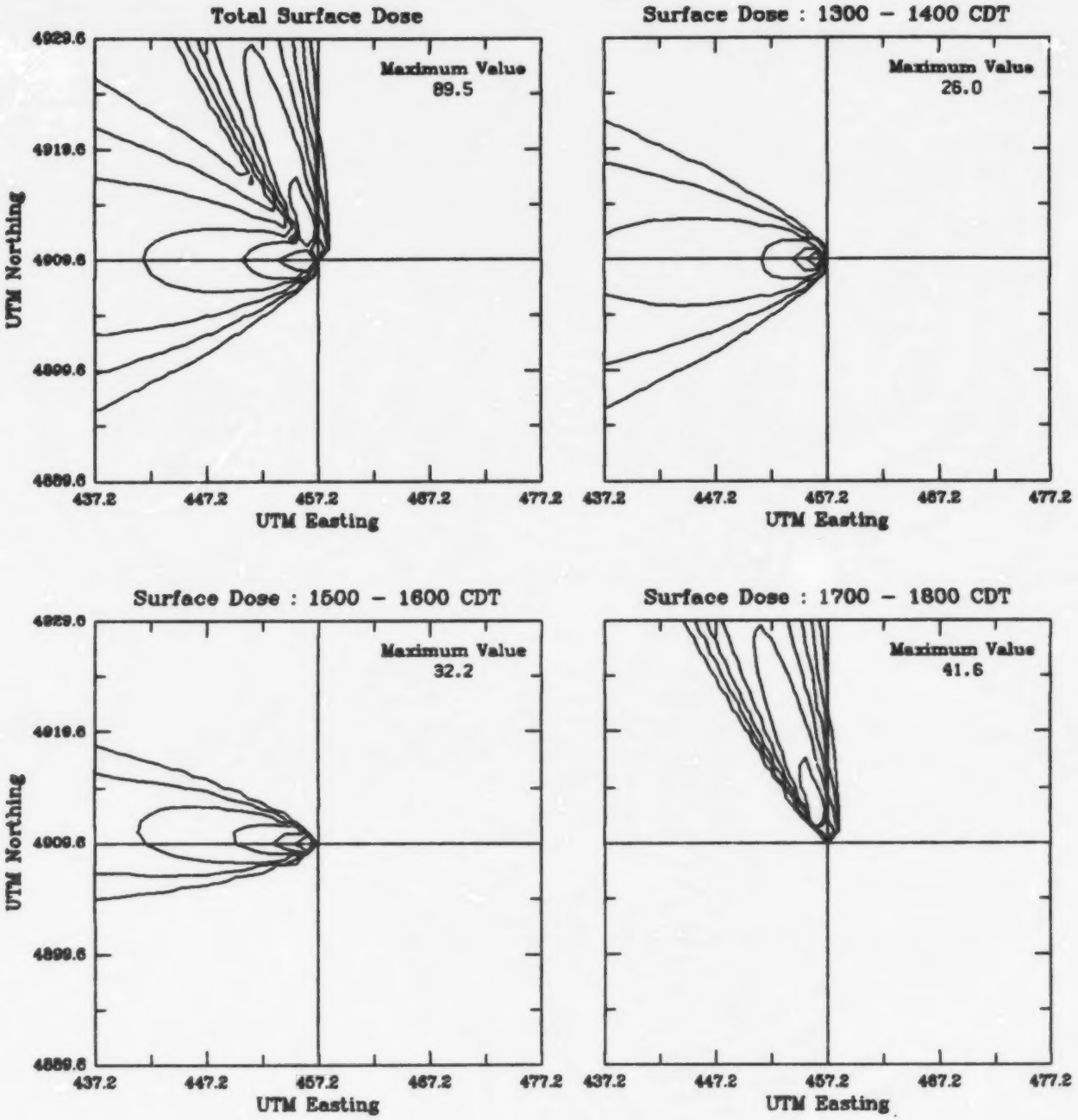
TEM : TEST 1



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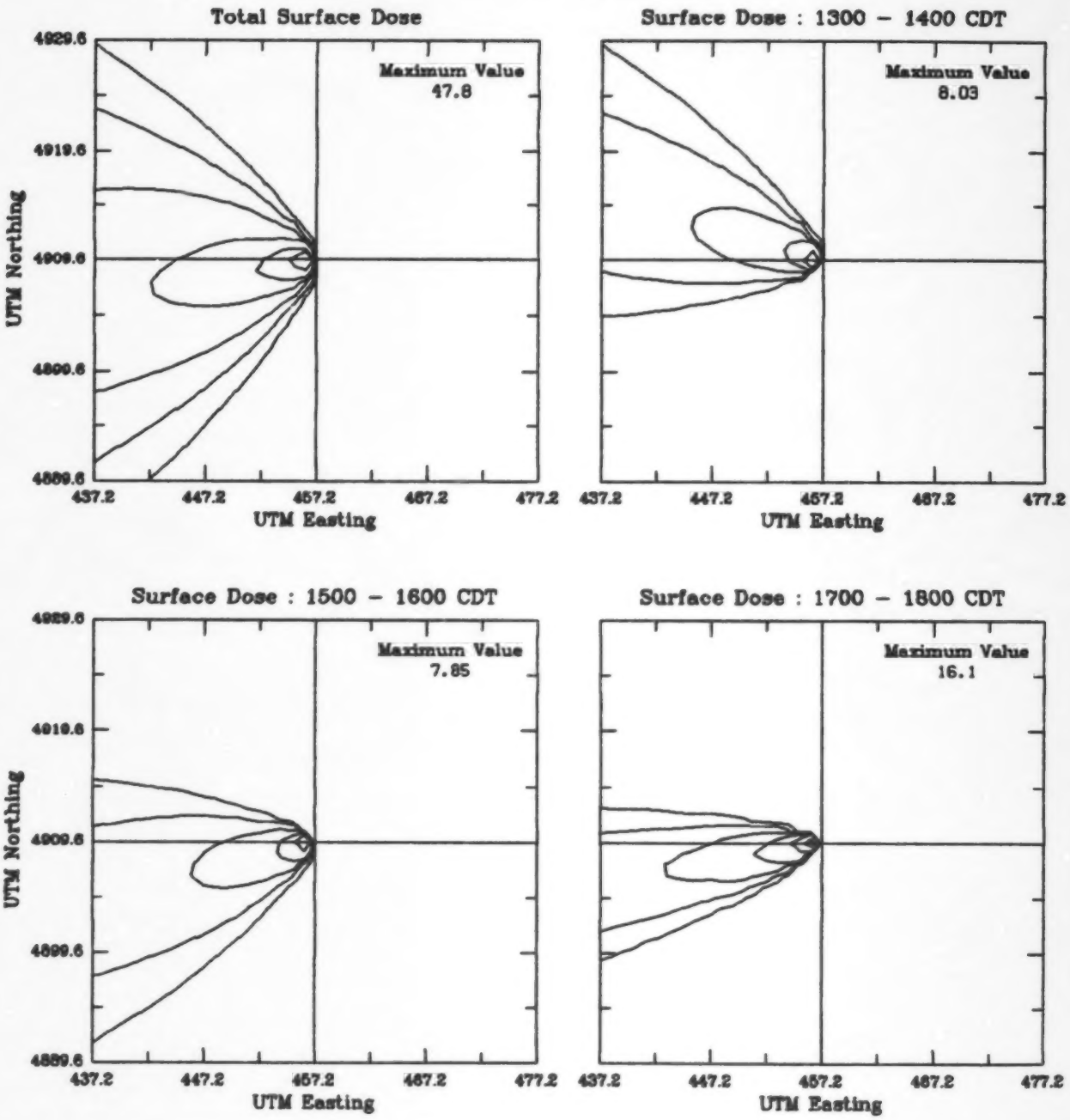
TEM : TEST 2



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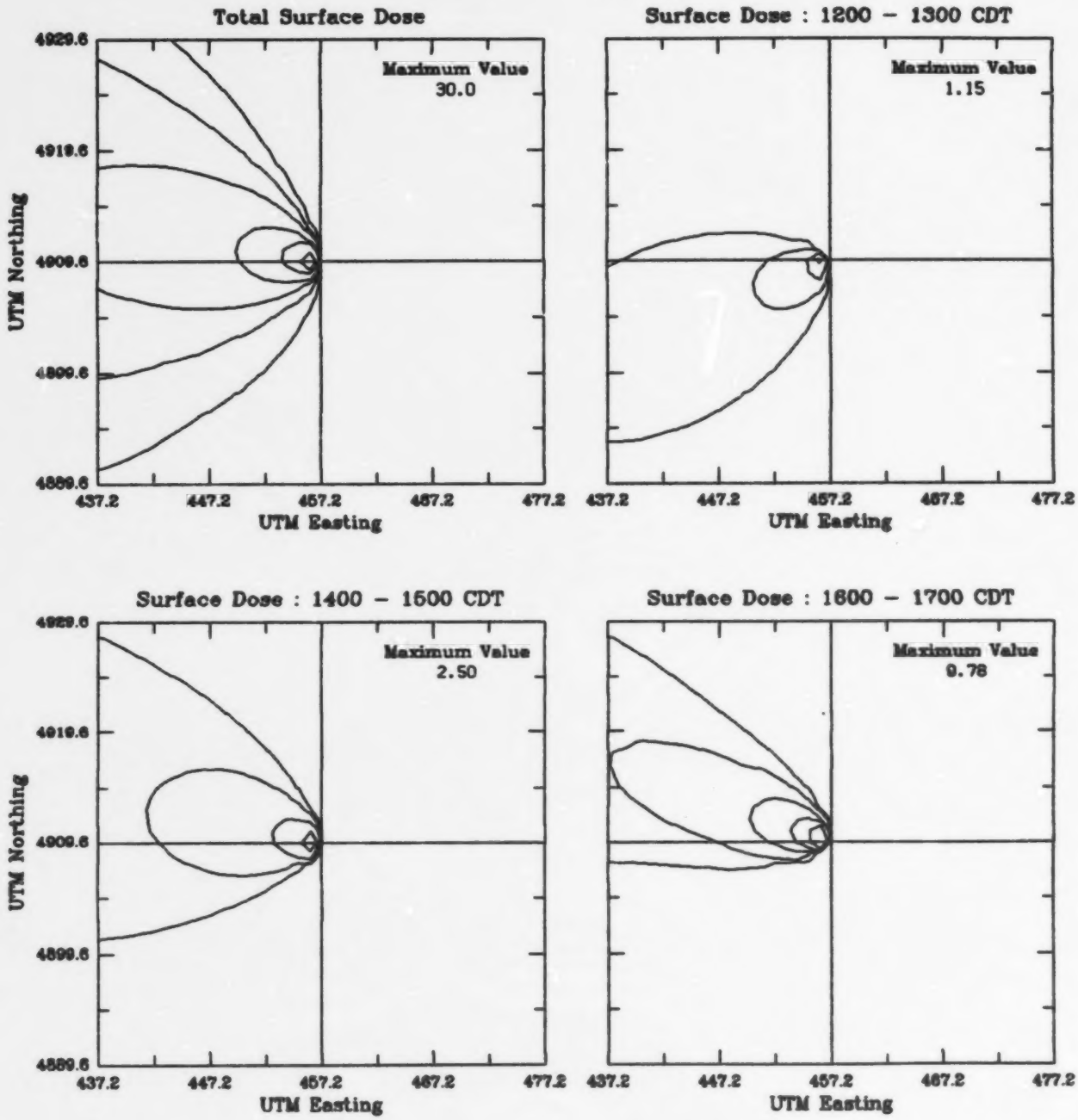
TEM : TEST 3



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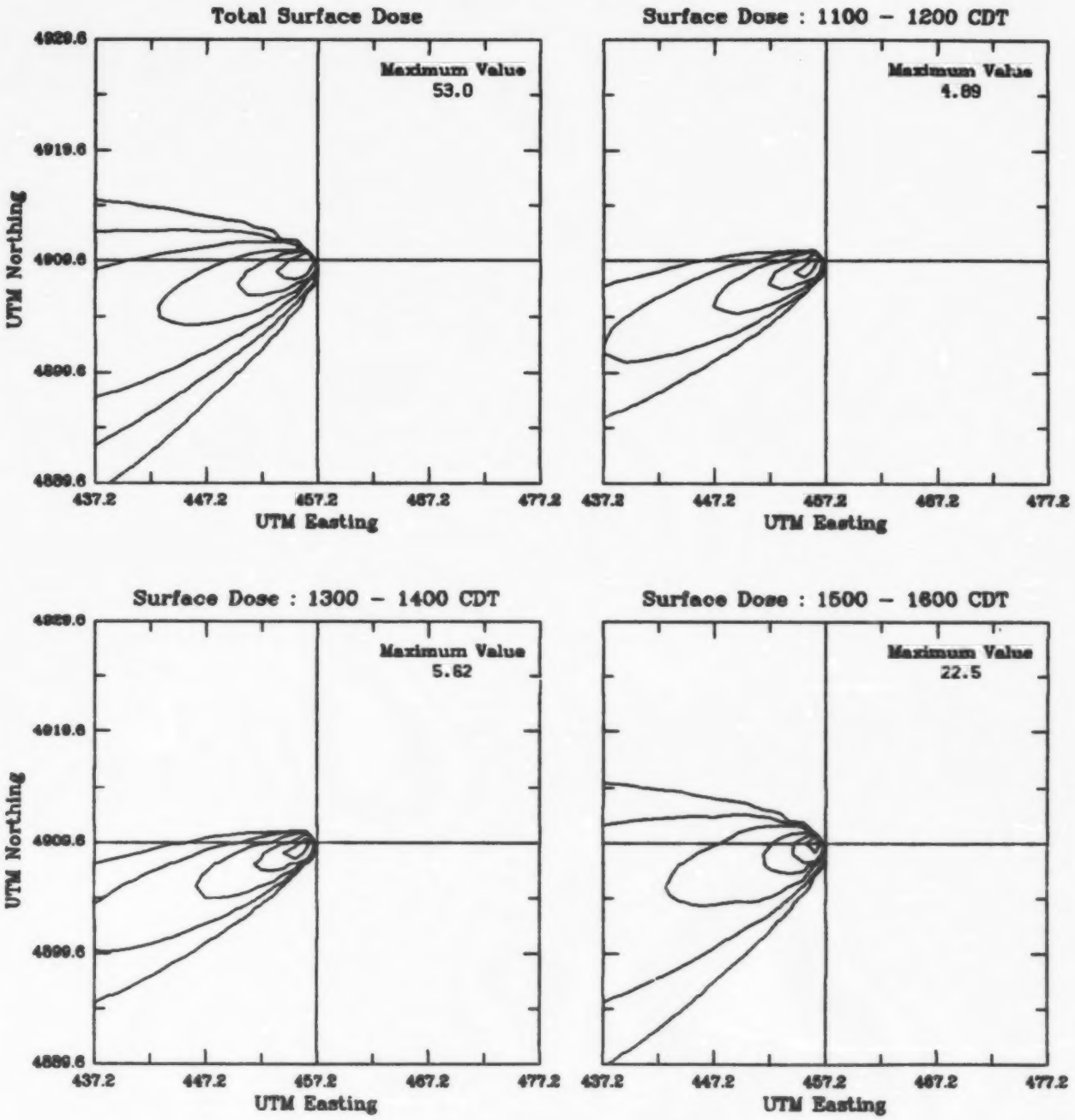
TEM : TEST 4



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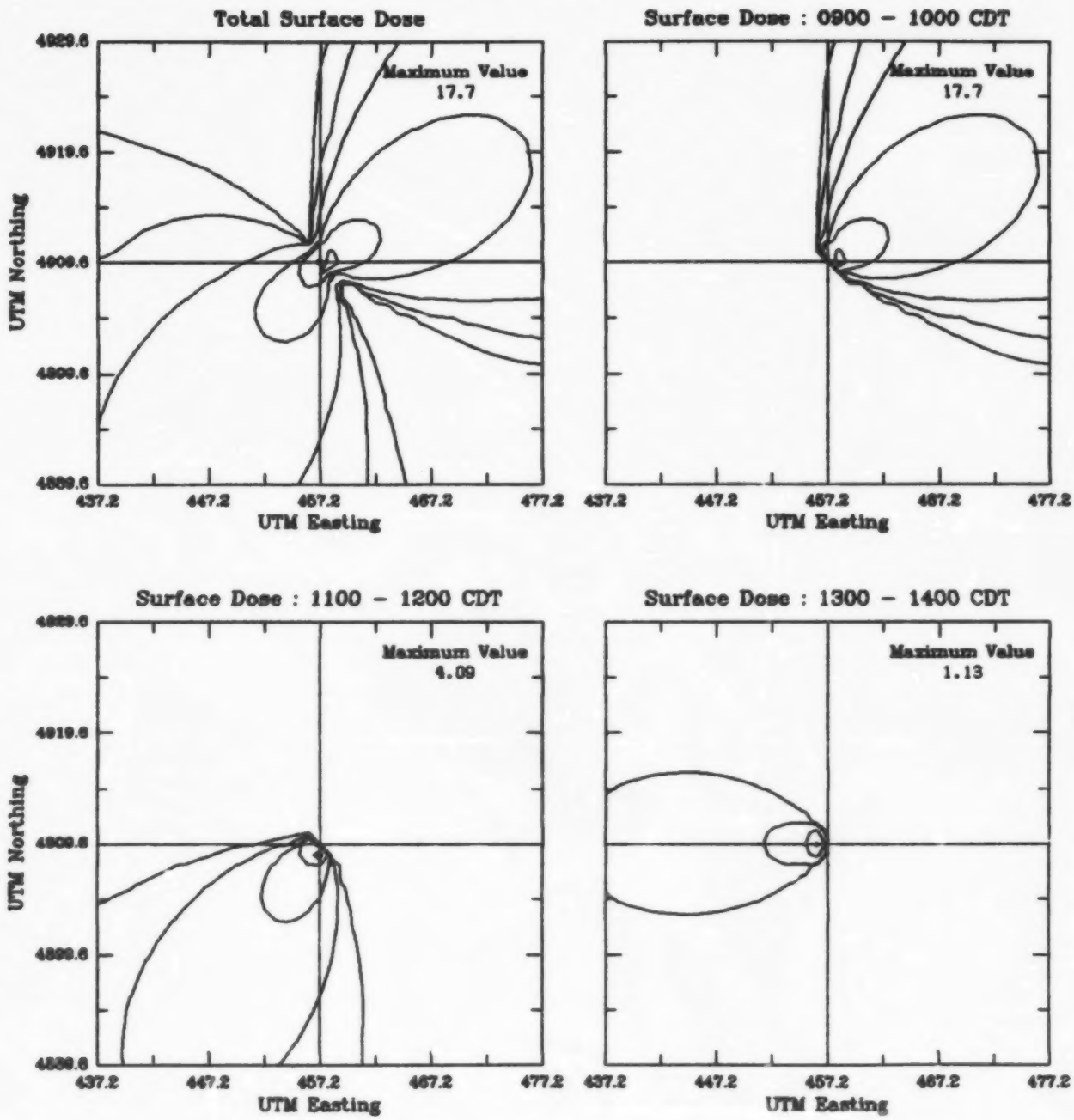
TEM : TEST 6



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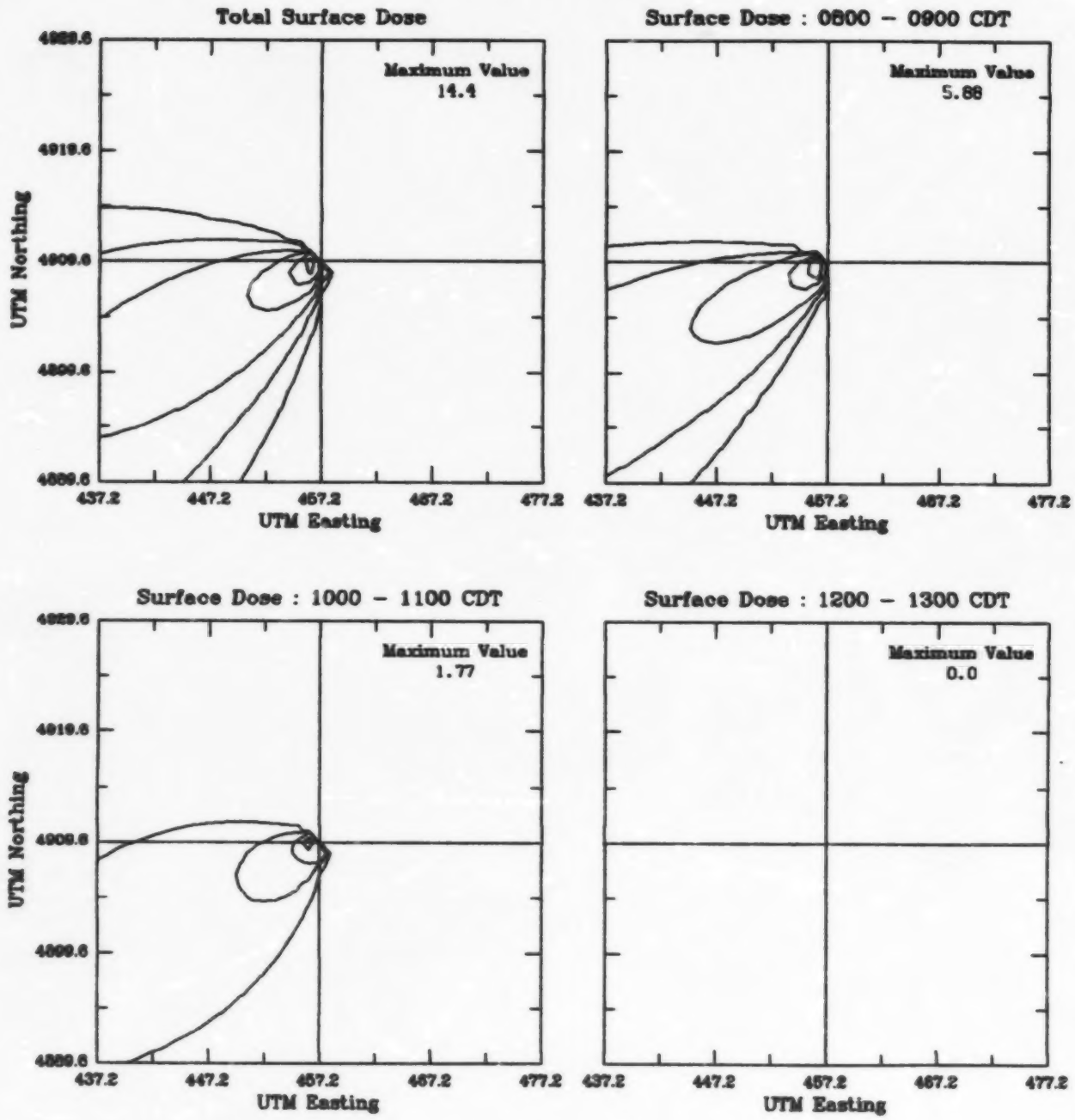

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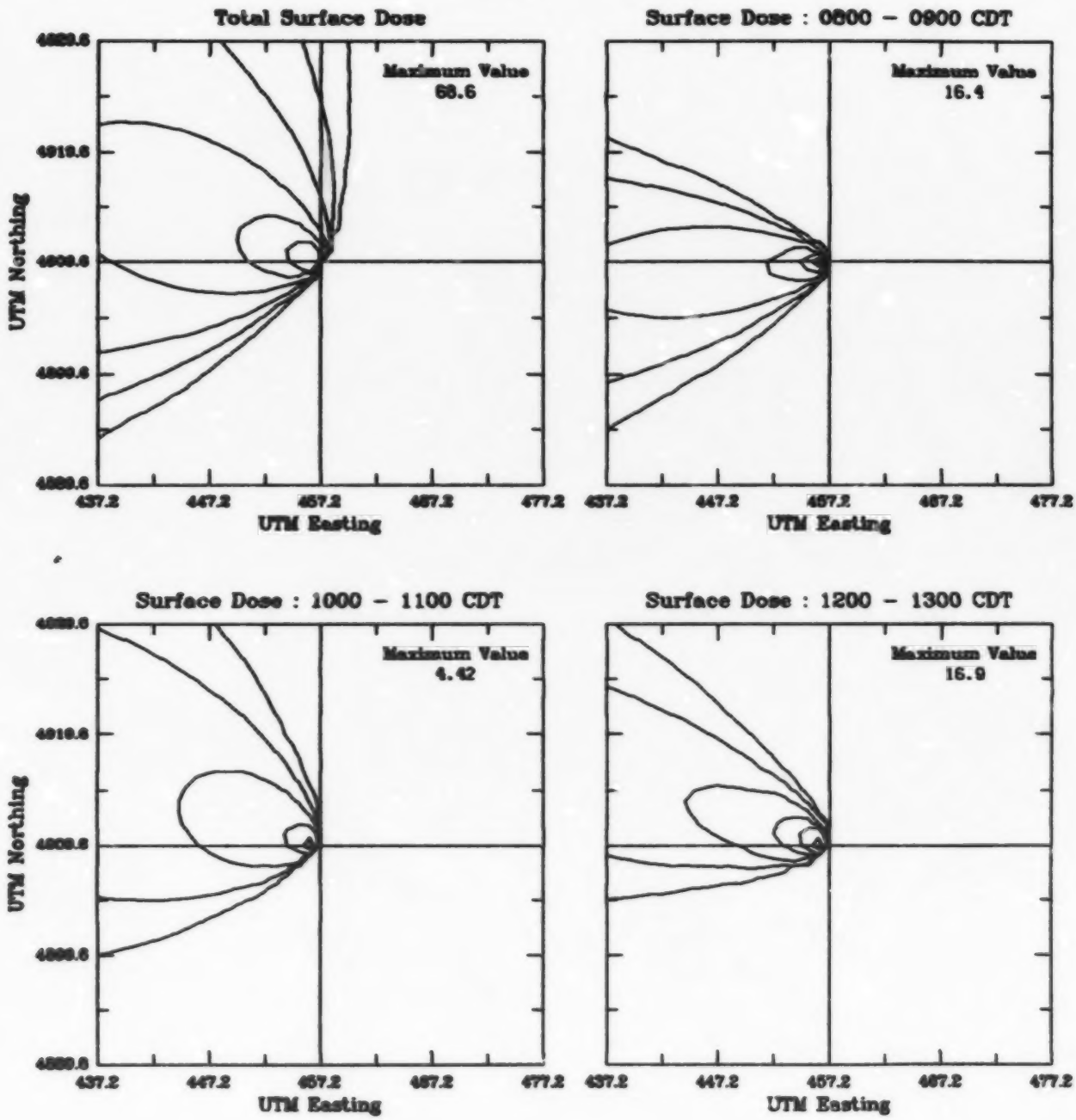
BEST COPY AVAILABLE

TEM : TEST 8

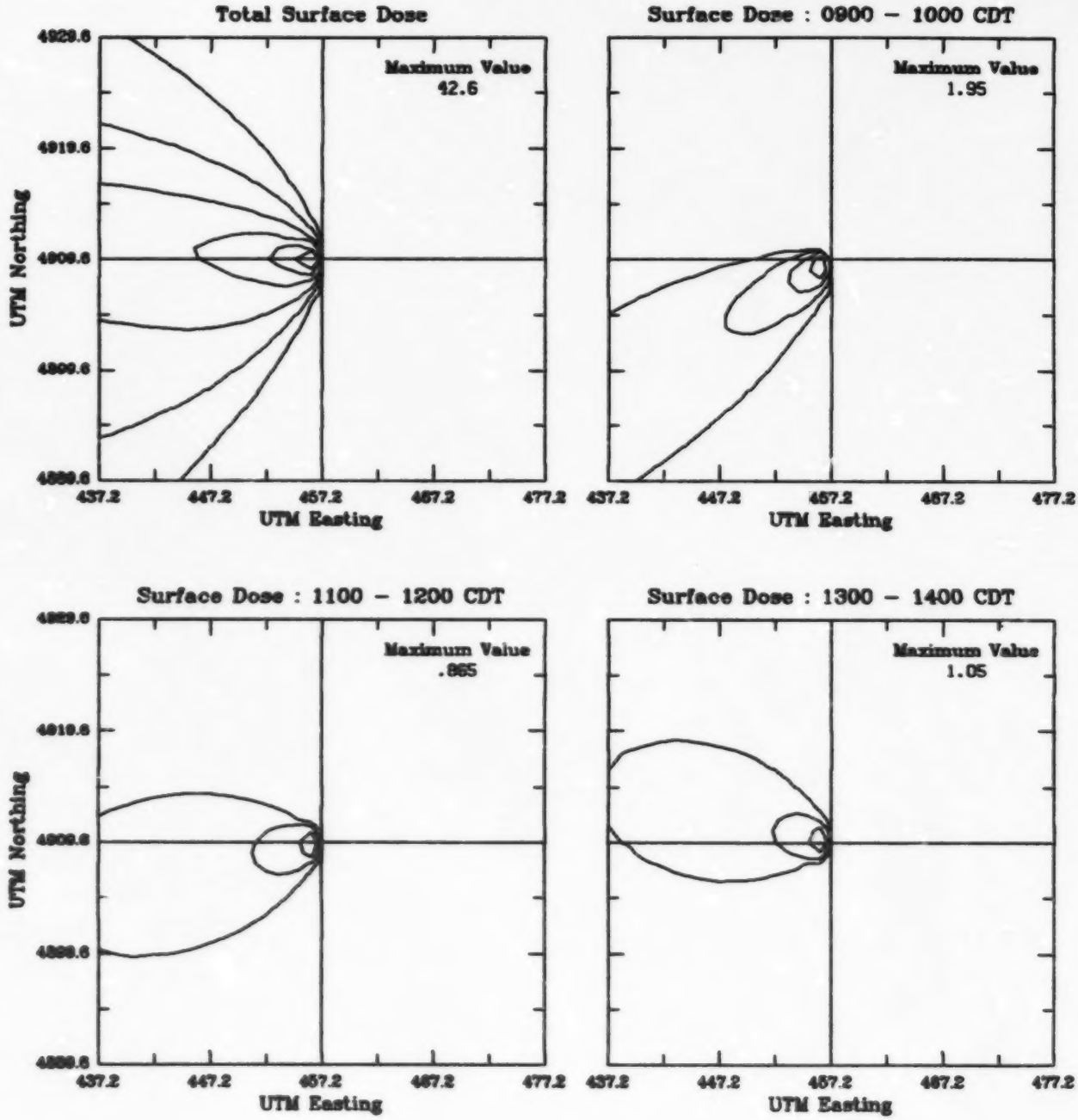


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

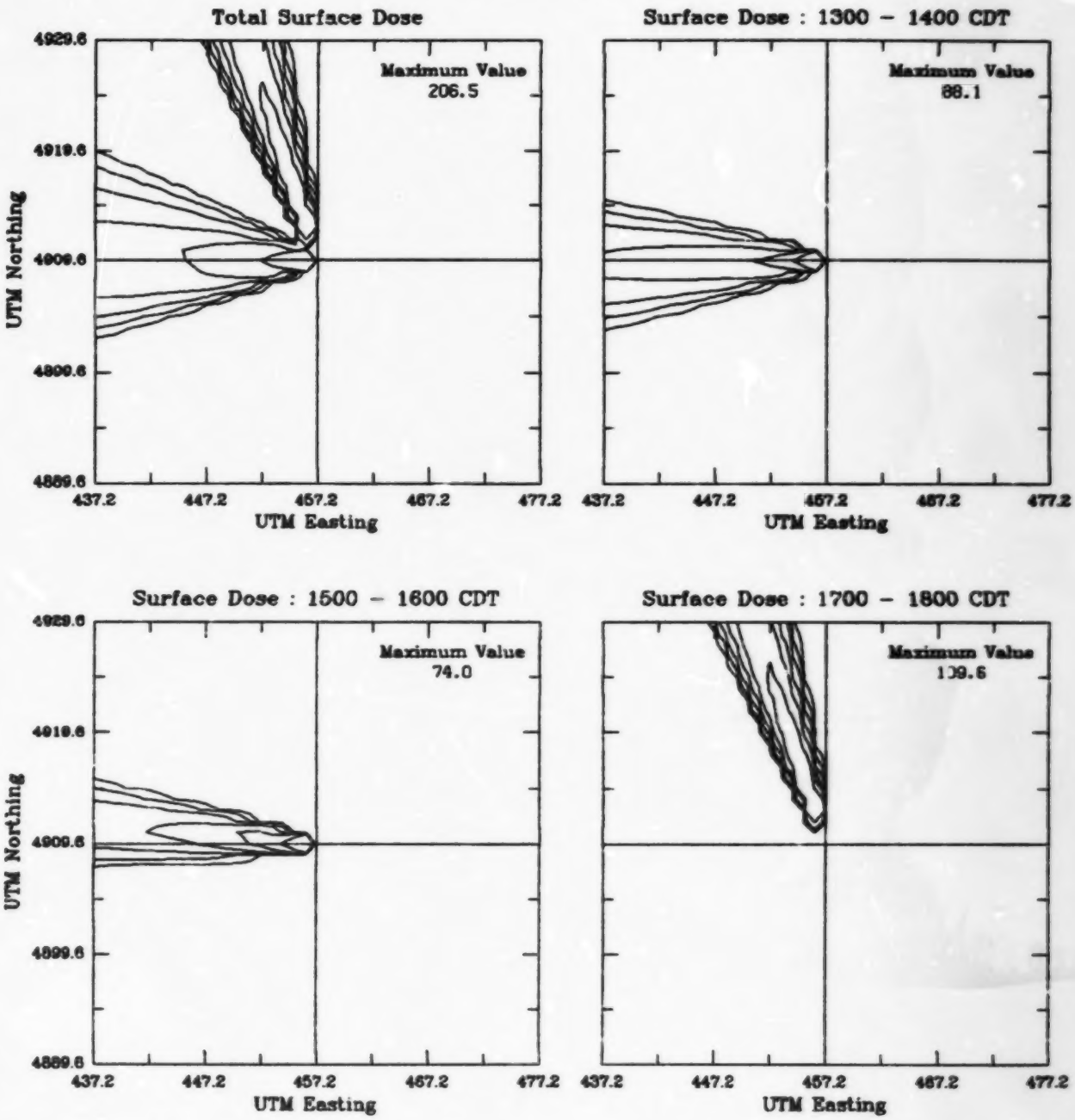
TEM : TEST 9



6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

ISC : TEST 1

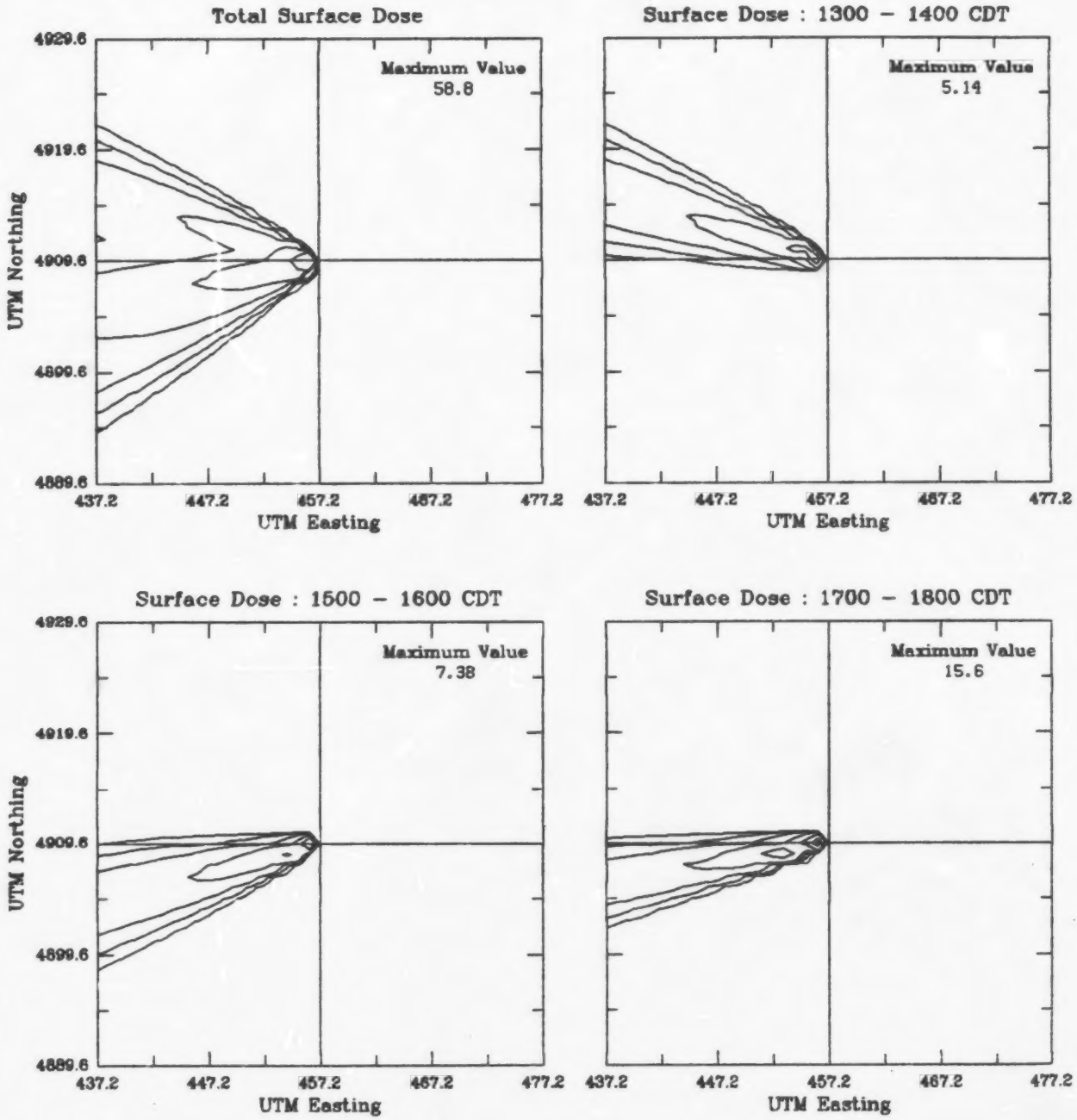


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ISC : TEST 2

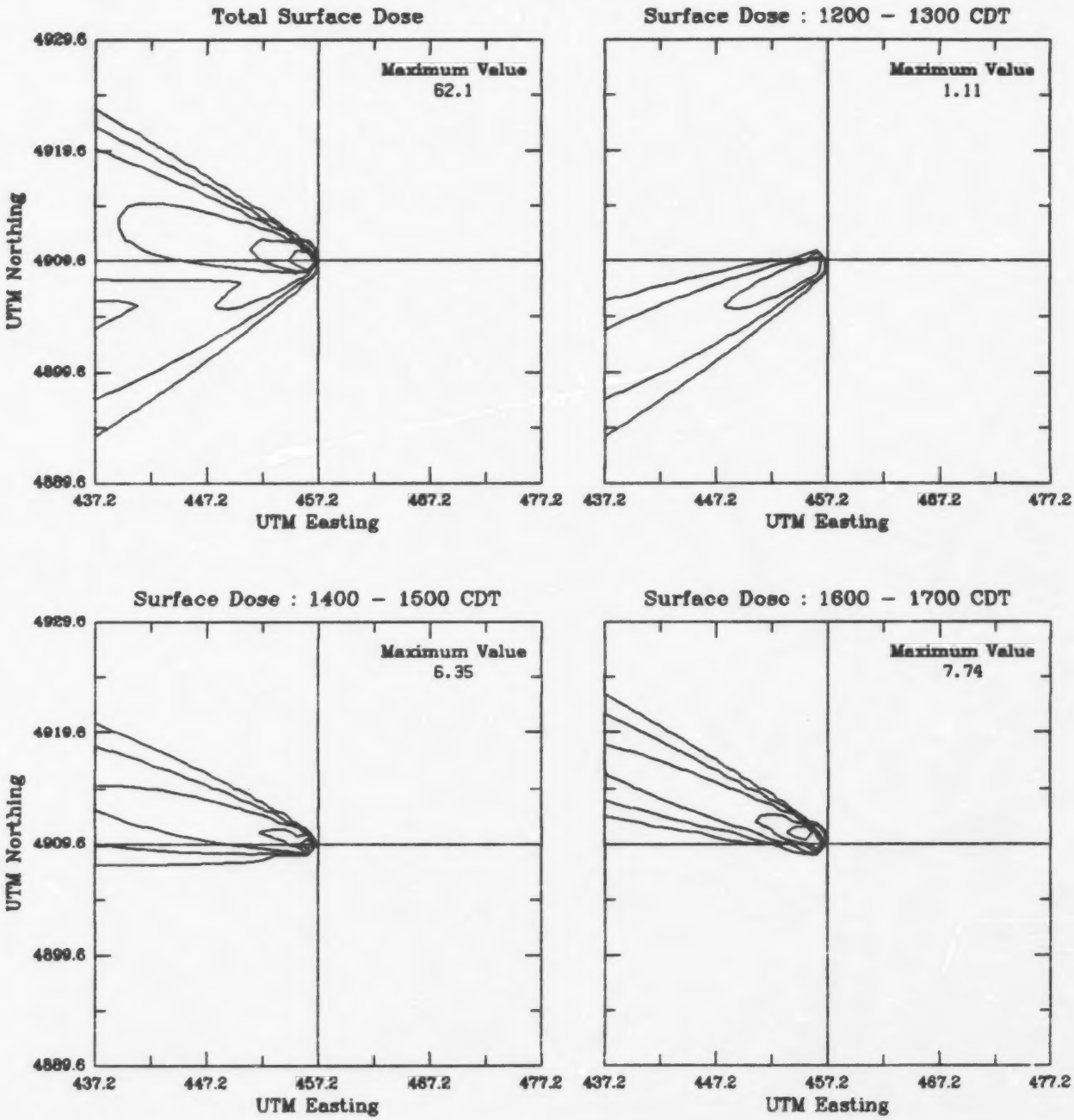


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

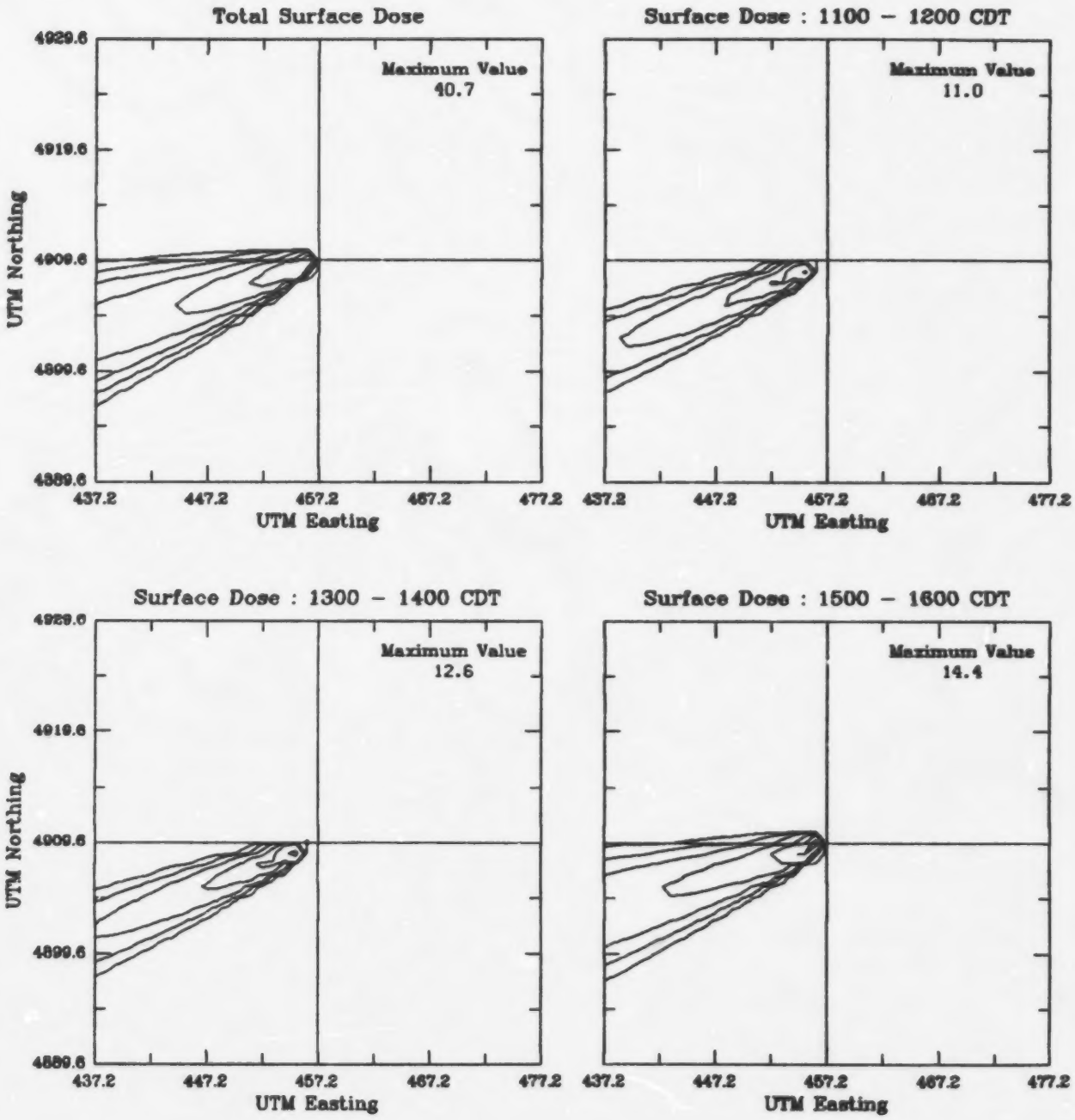
ISC : TEST 3



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ISC : TEST 4

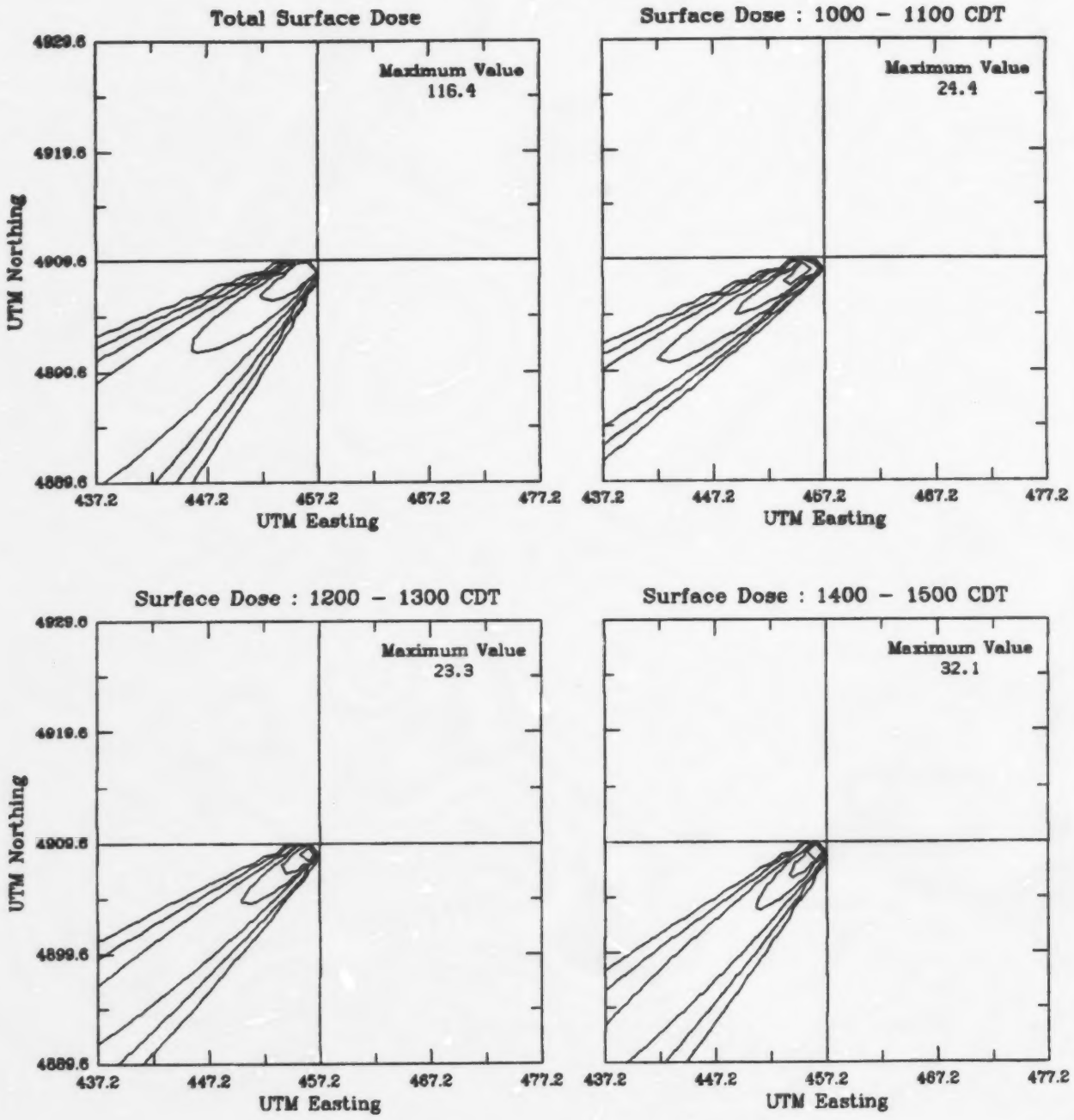


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ISC : TEST 5

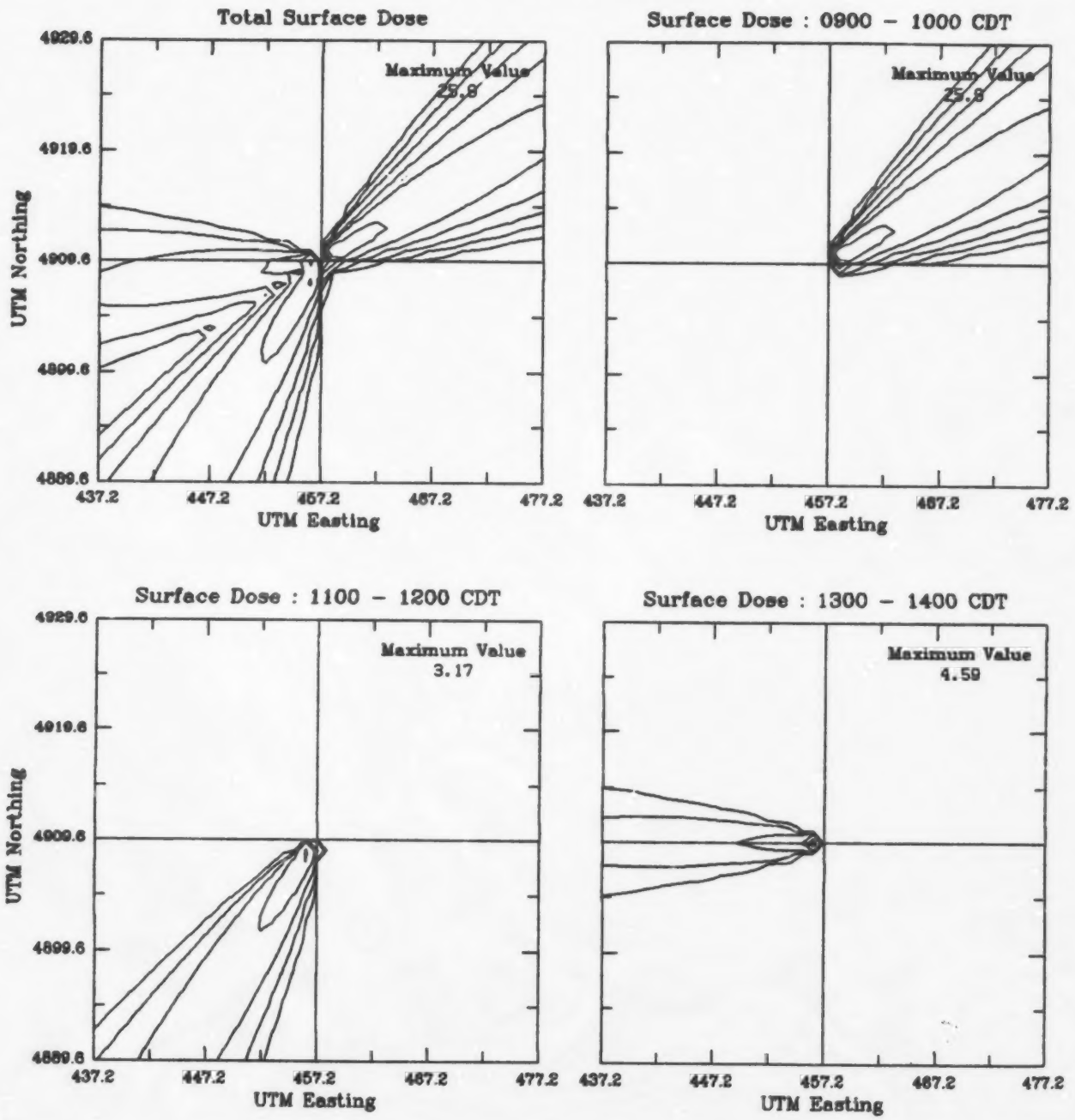


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ISC : TEST 6

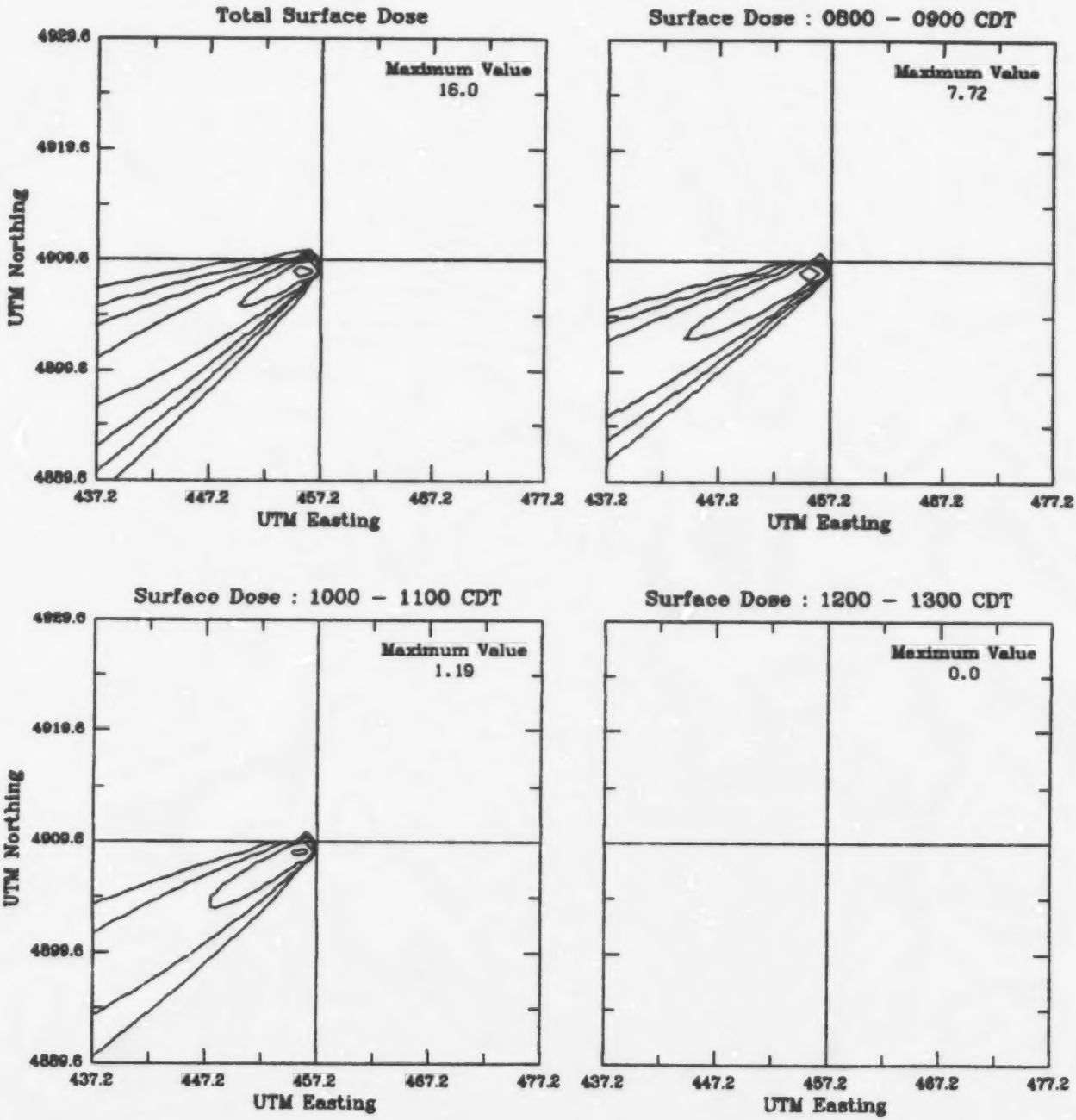


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ISC : TEST 7

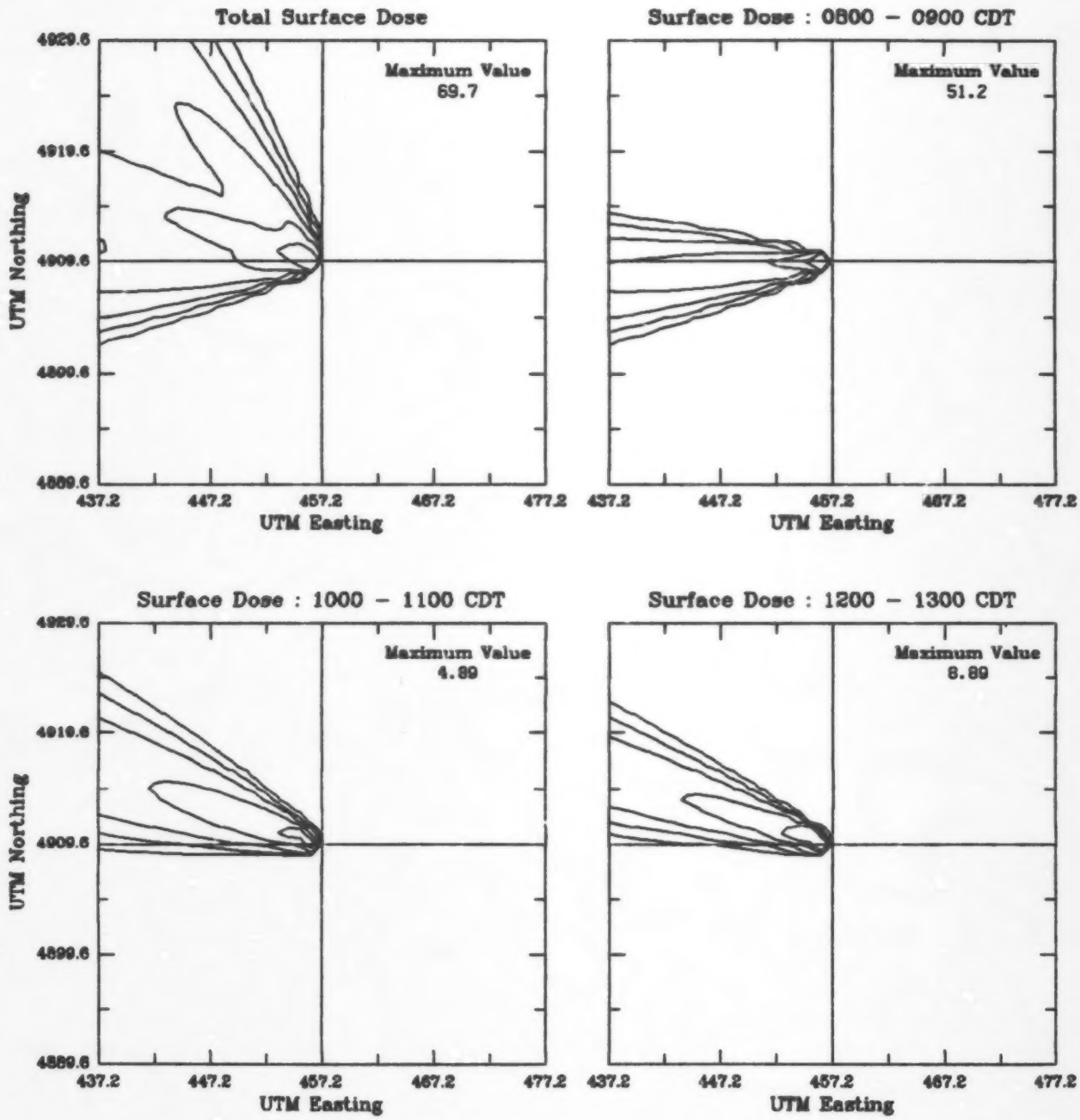


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ISC : TEST 8

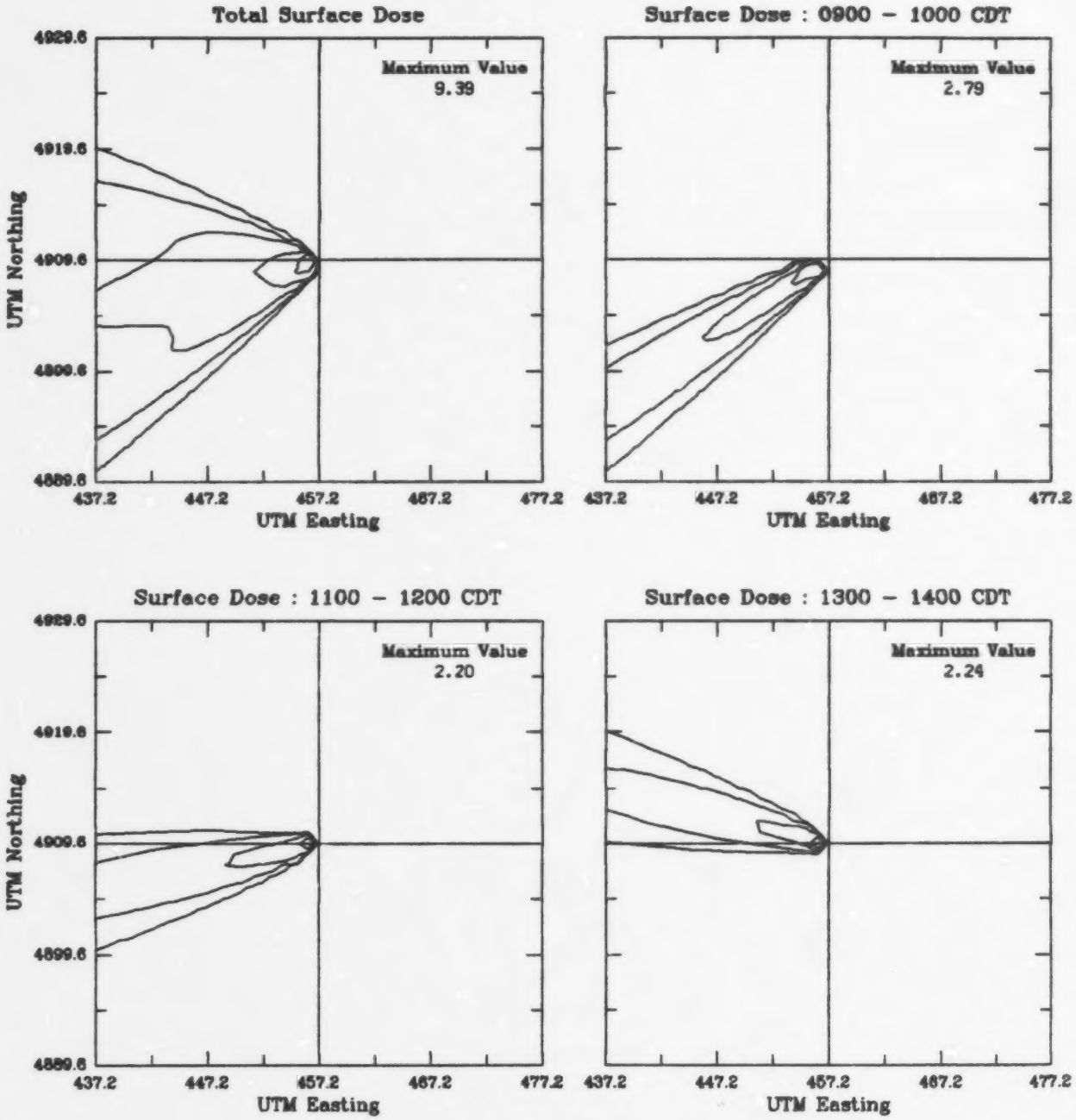


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ISC : TEST 9

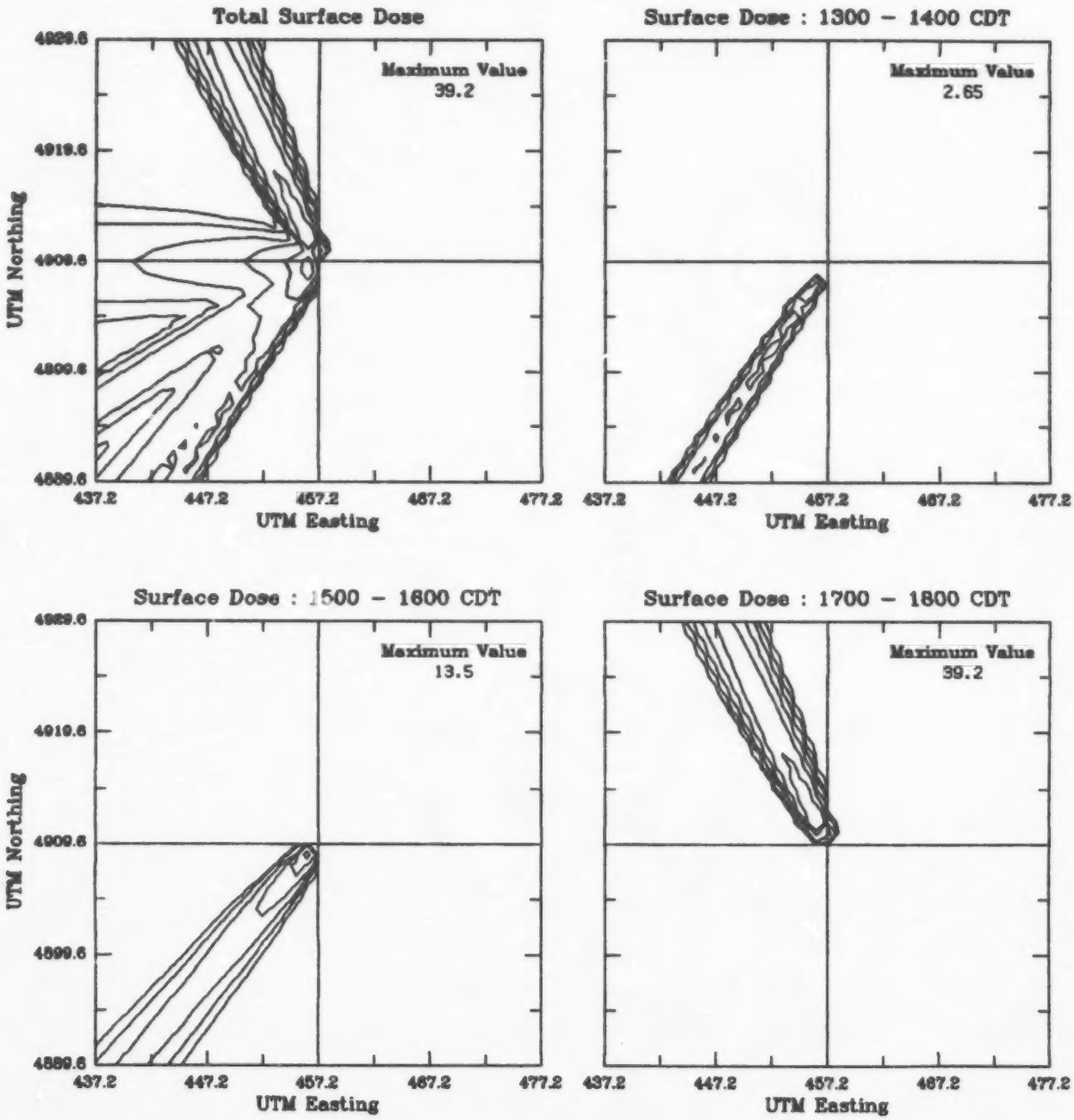


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GAUSS : TEST 1

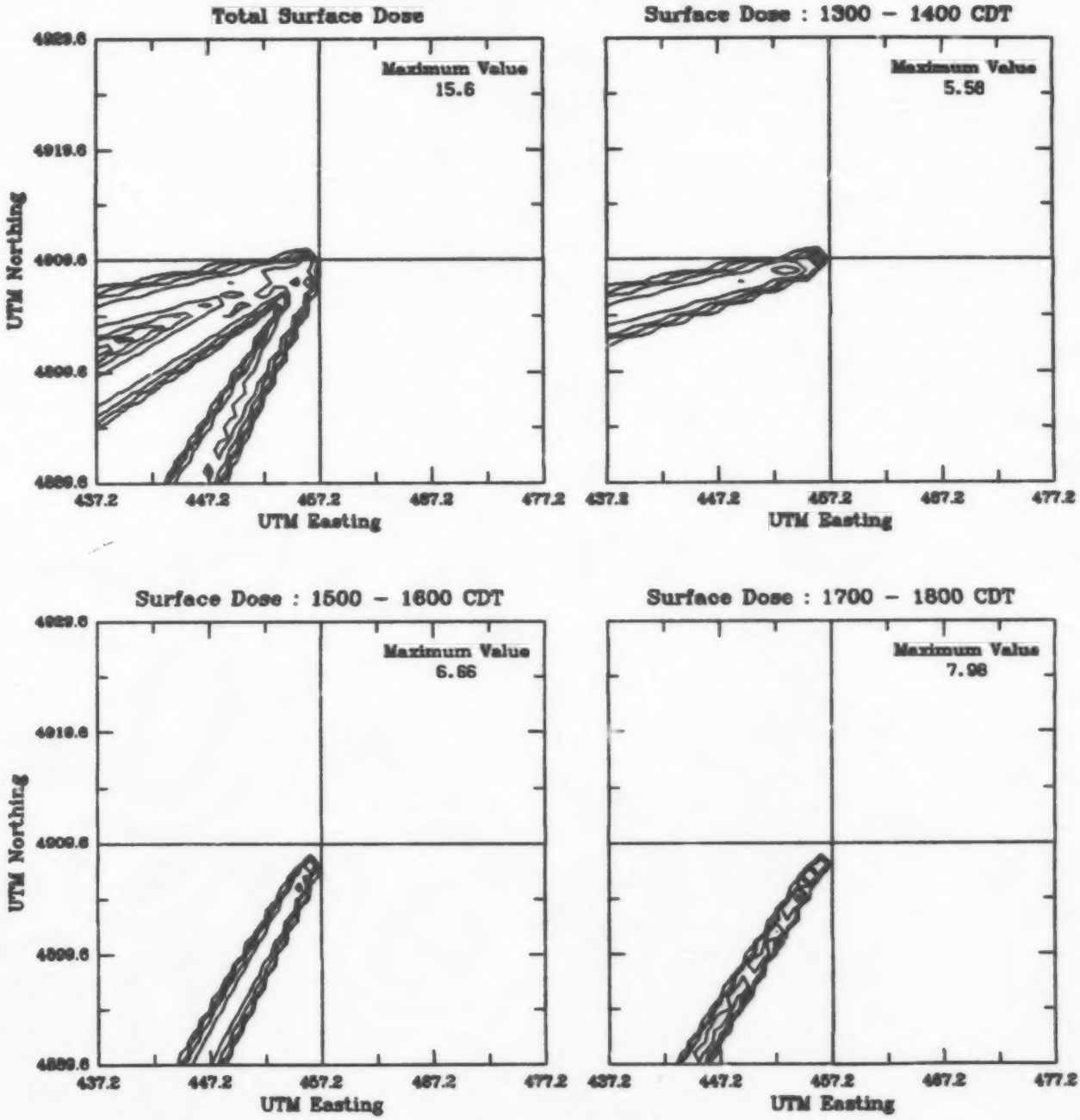


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

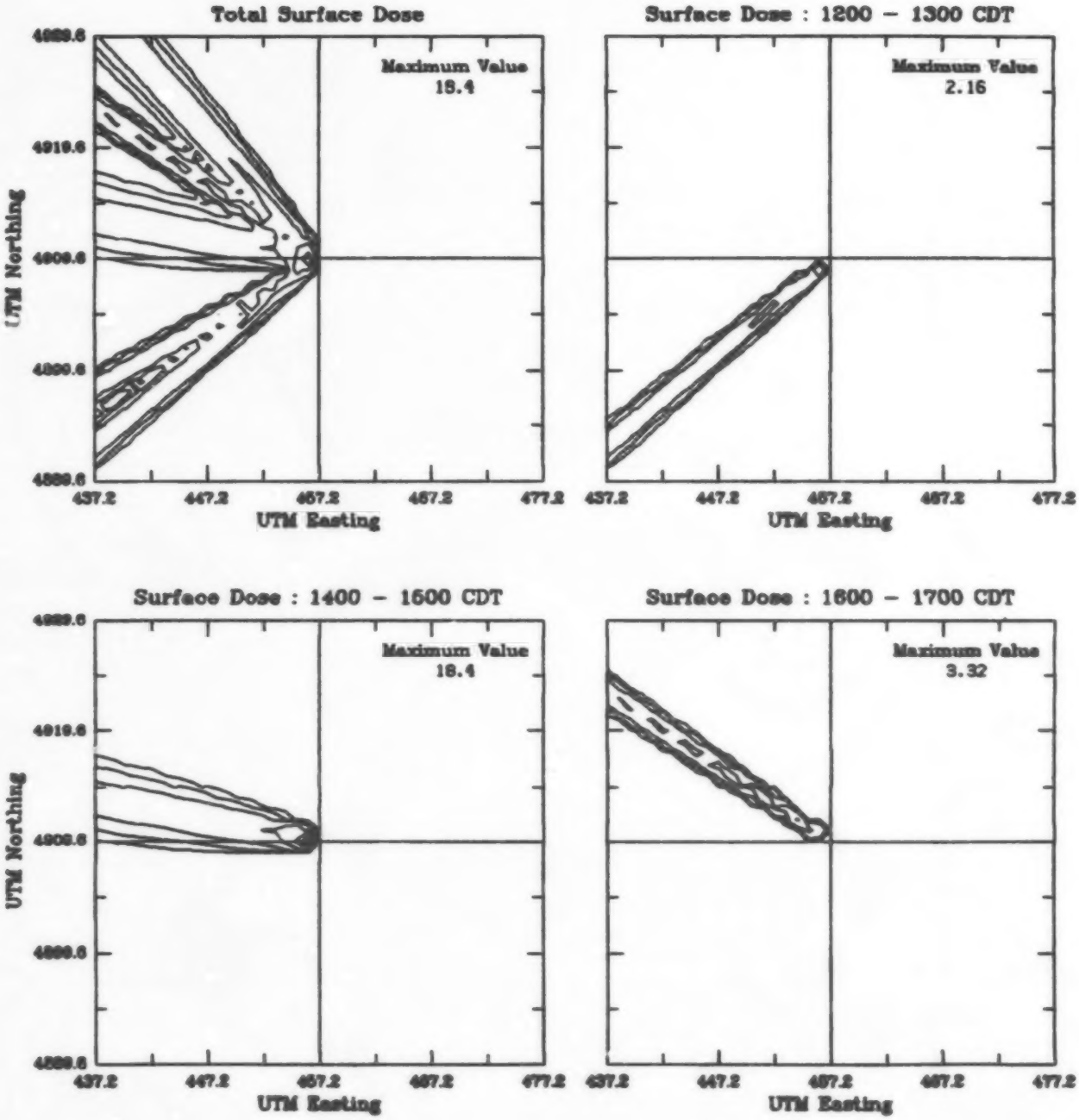
GAUSS : TEST 2



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GAUSS : TEST 3

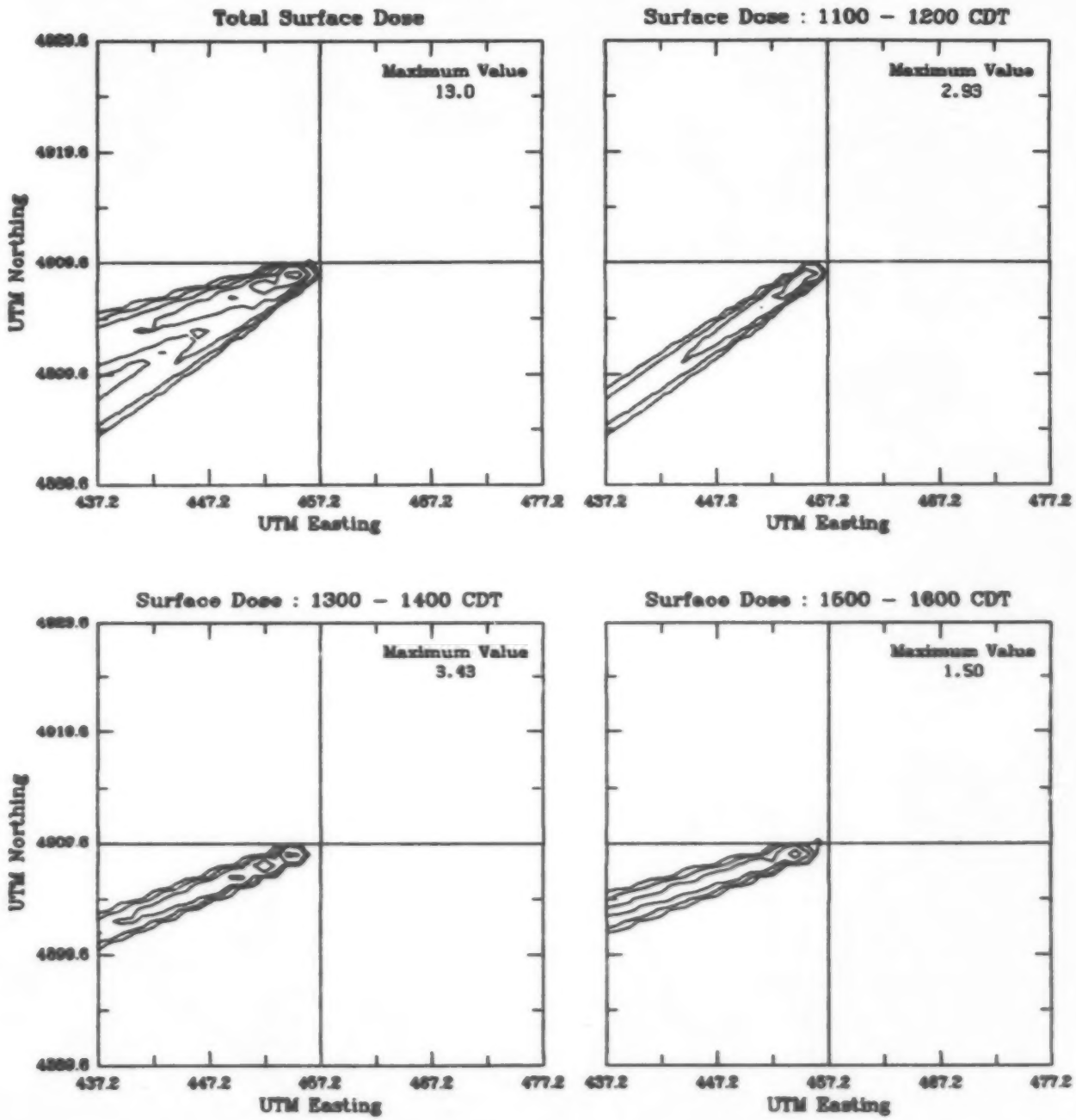


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GAUSS : TEST 4

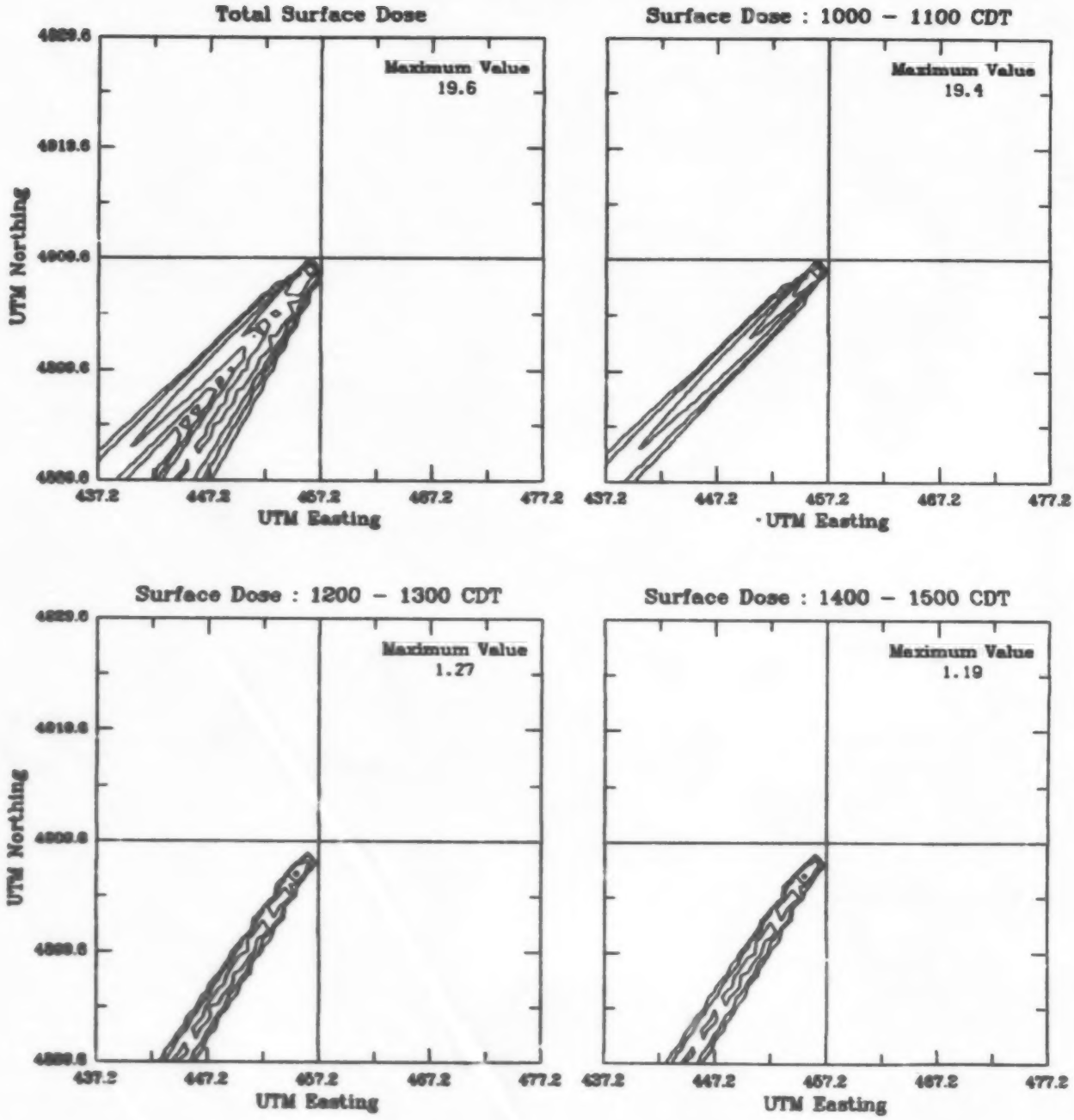


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GAUSS : TEST 5

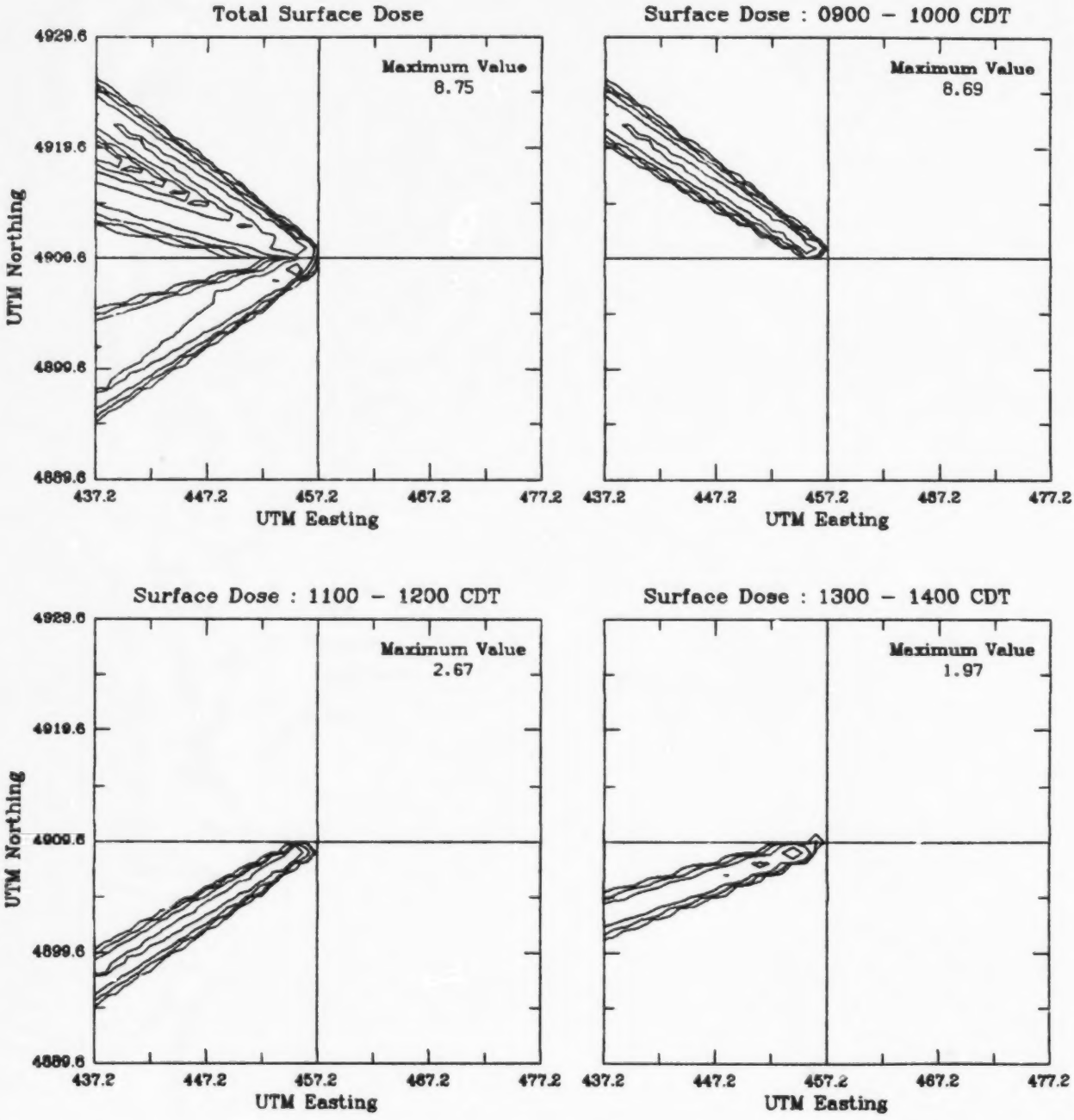


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GAUSS : TEST 6

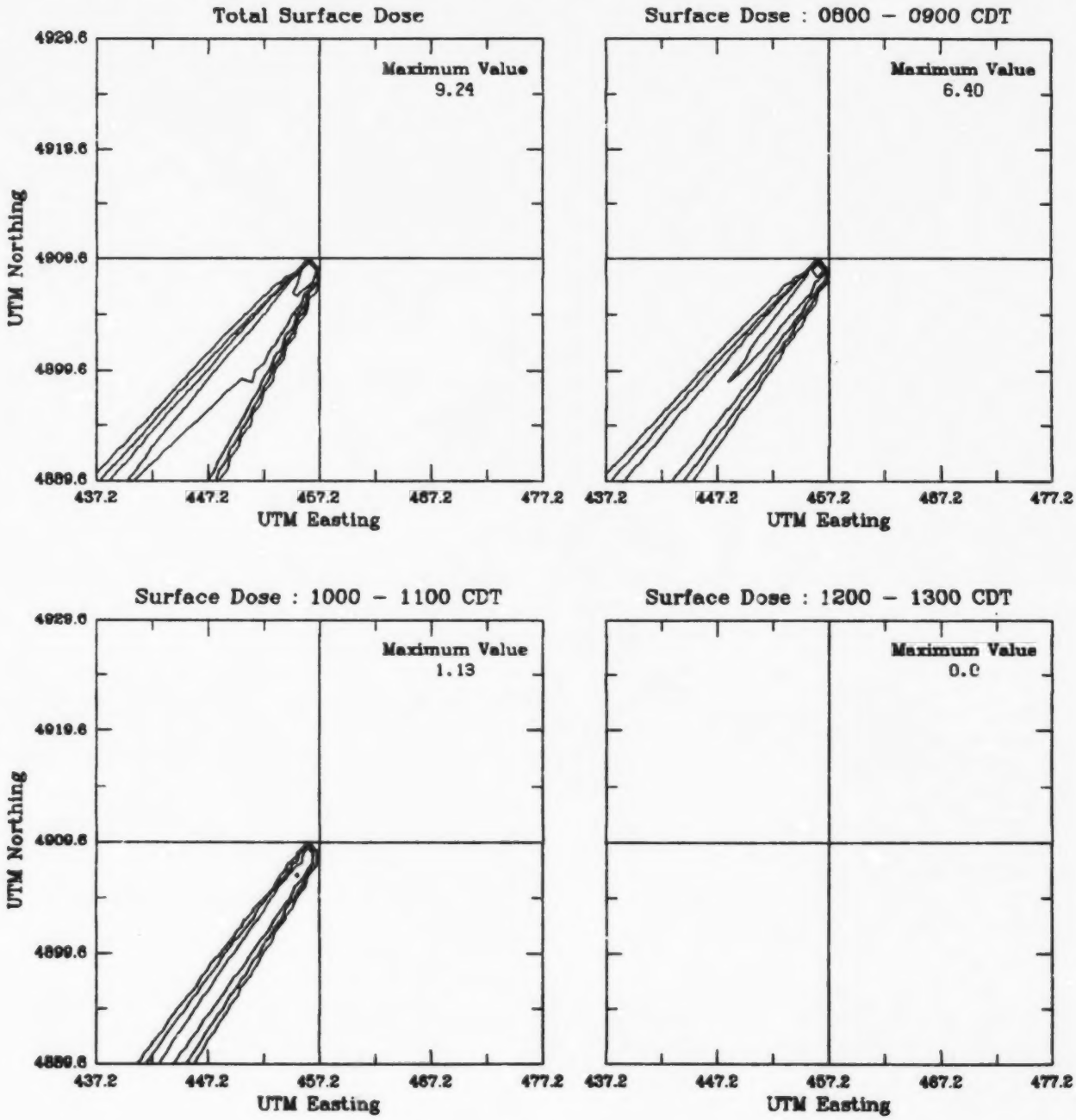


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GAUSS : TEST 7

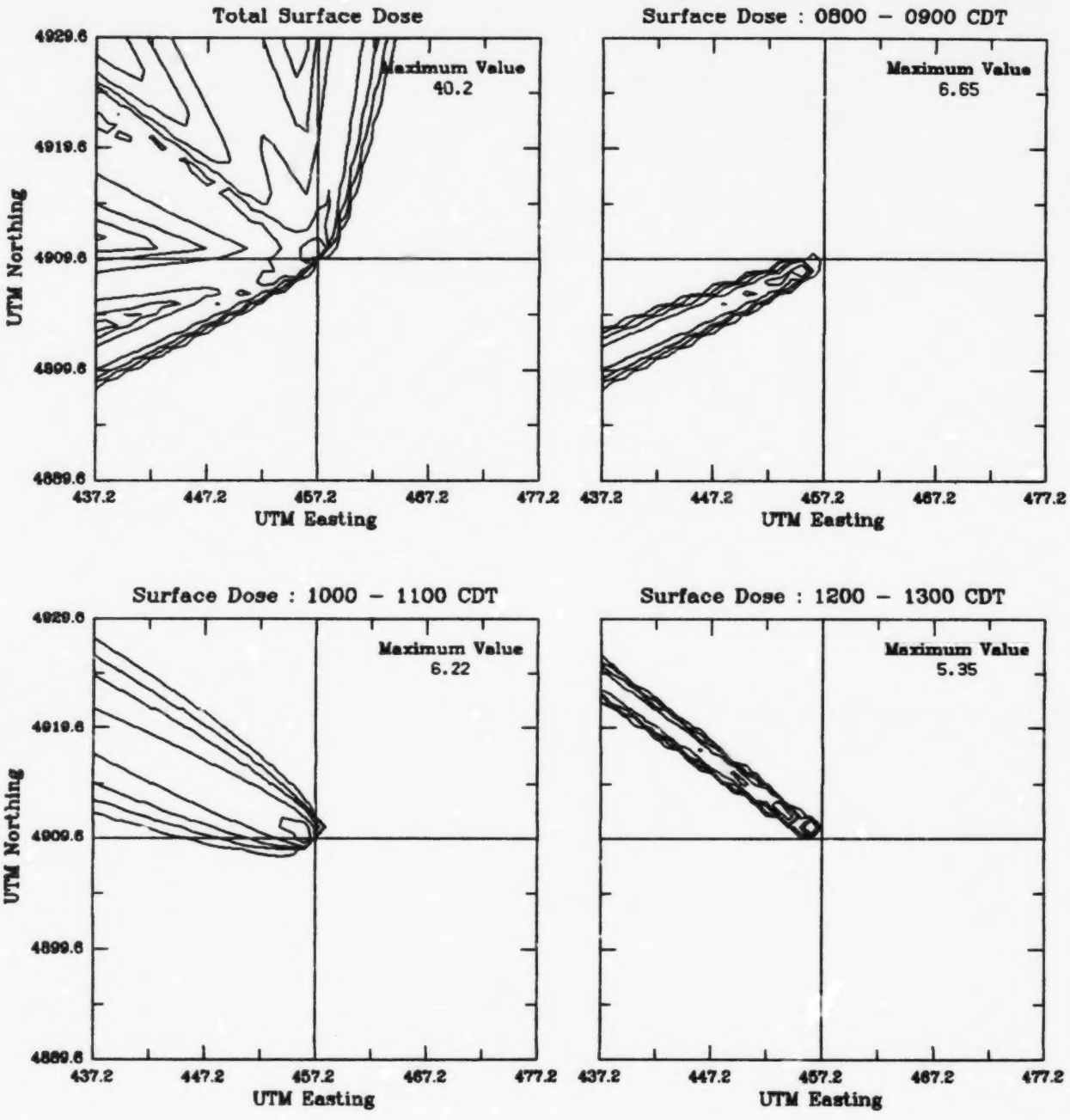


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GAUSS : TEST 8

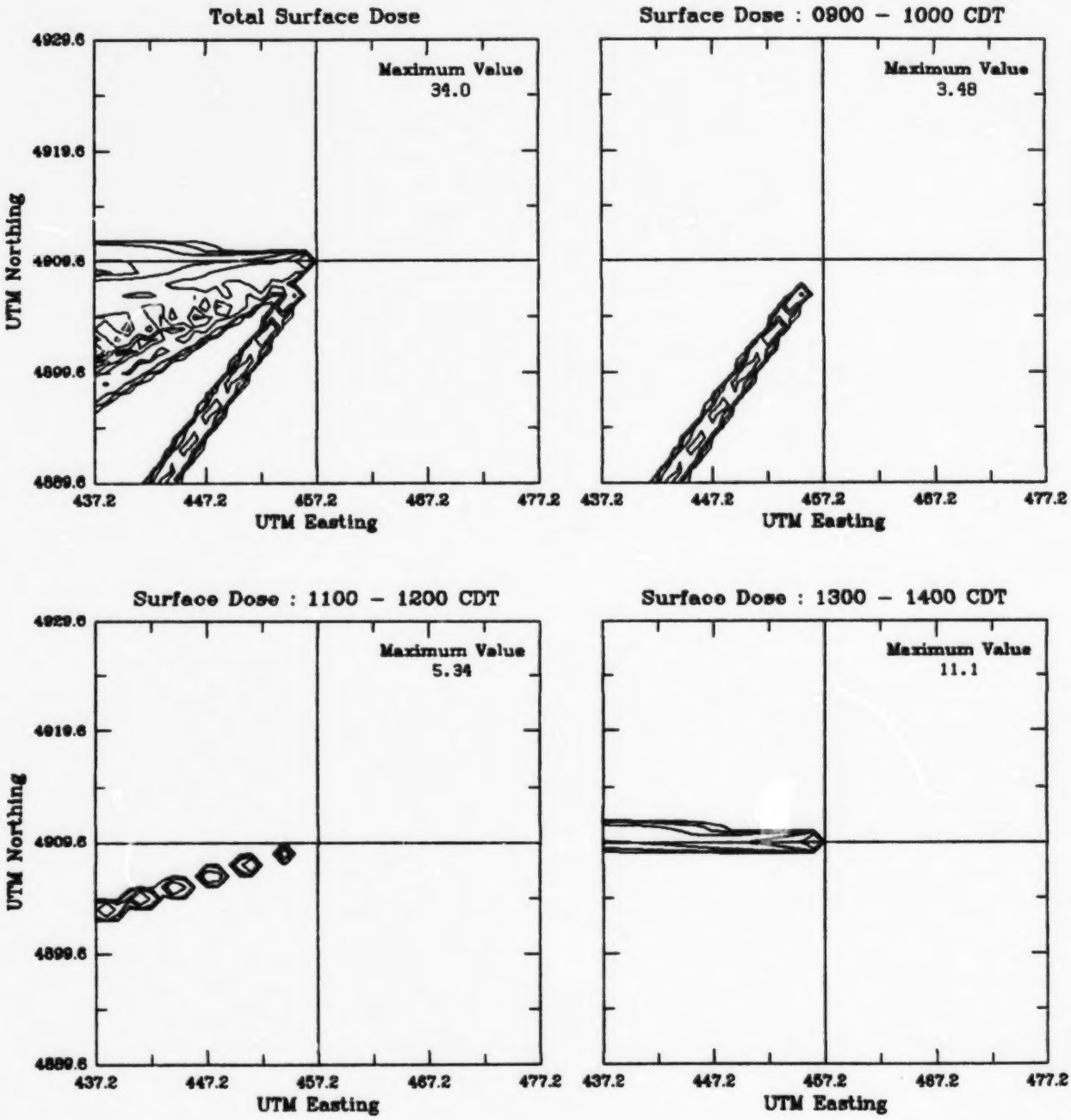


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GAUSS : TEST 9

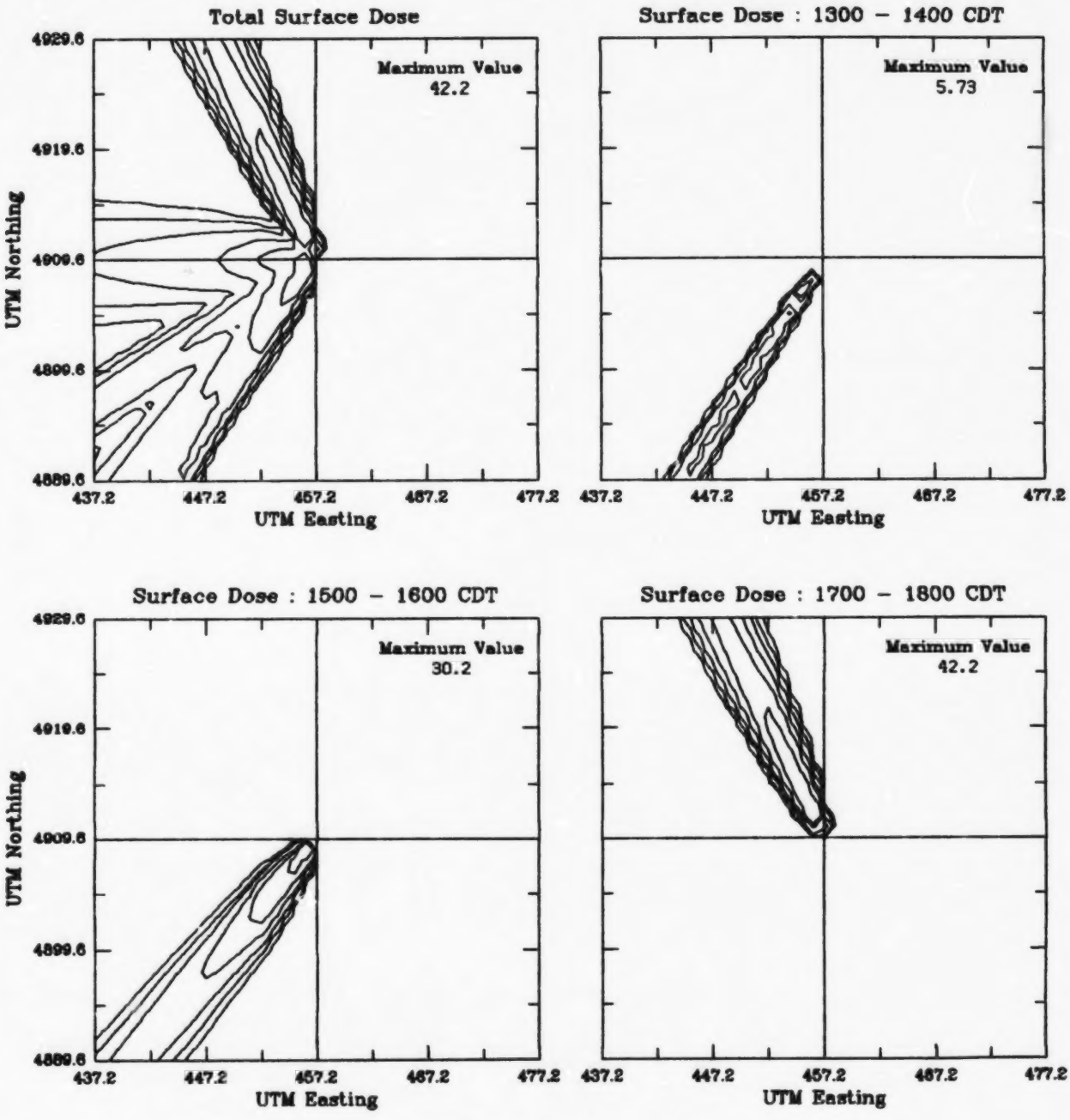


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GLUMP : TEST 1

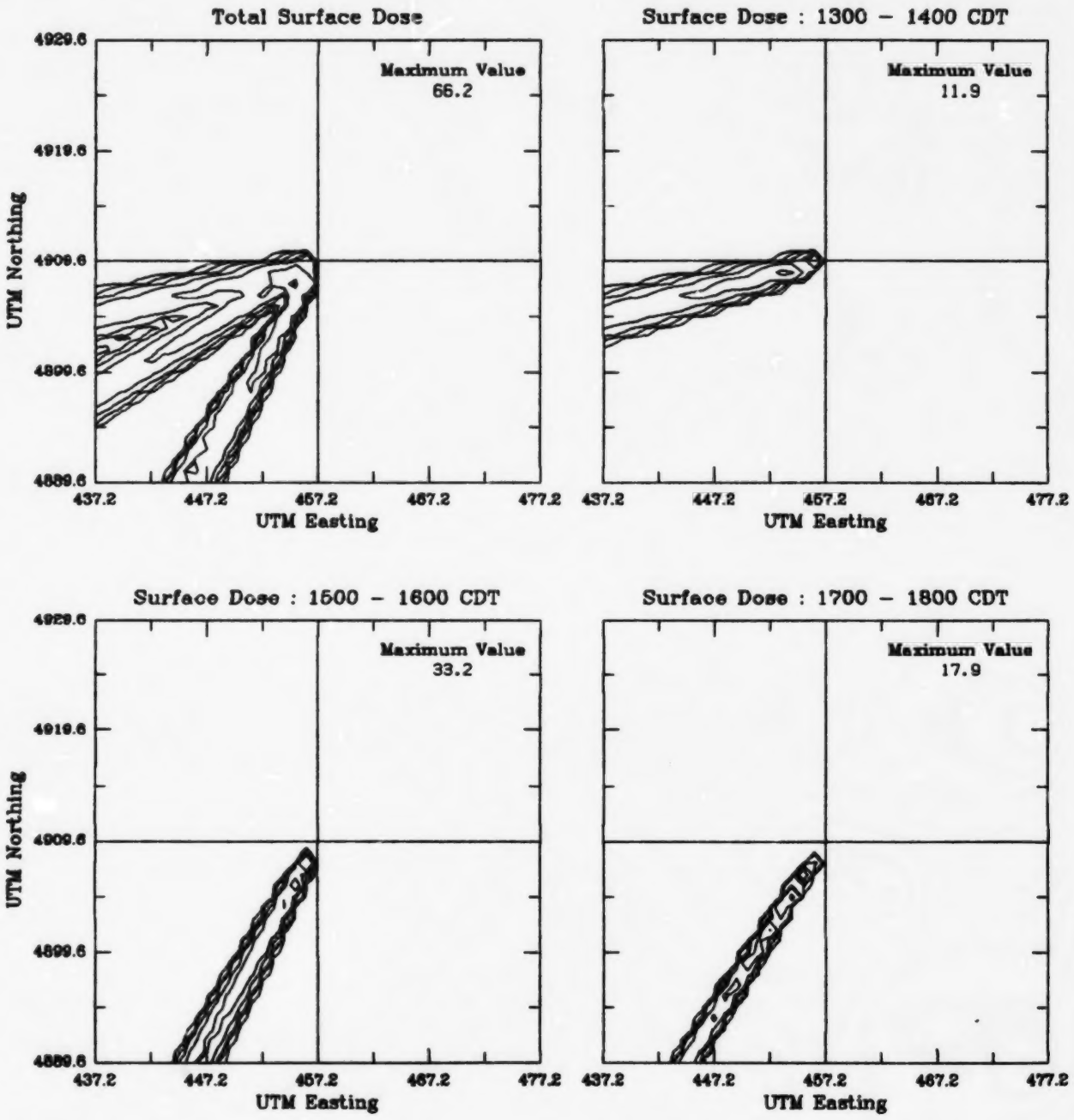


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GLUMP : TEST 2

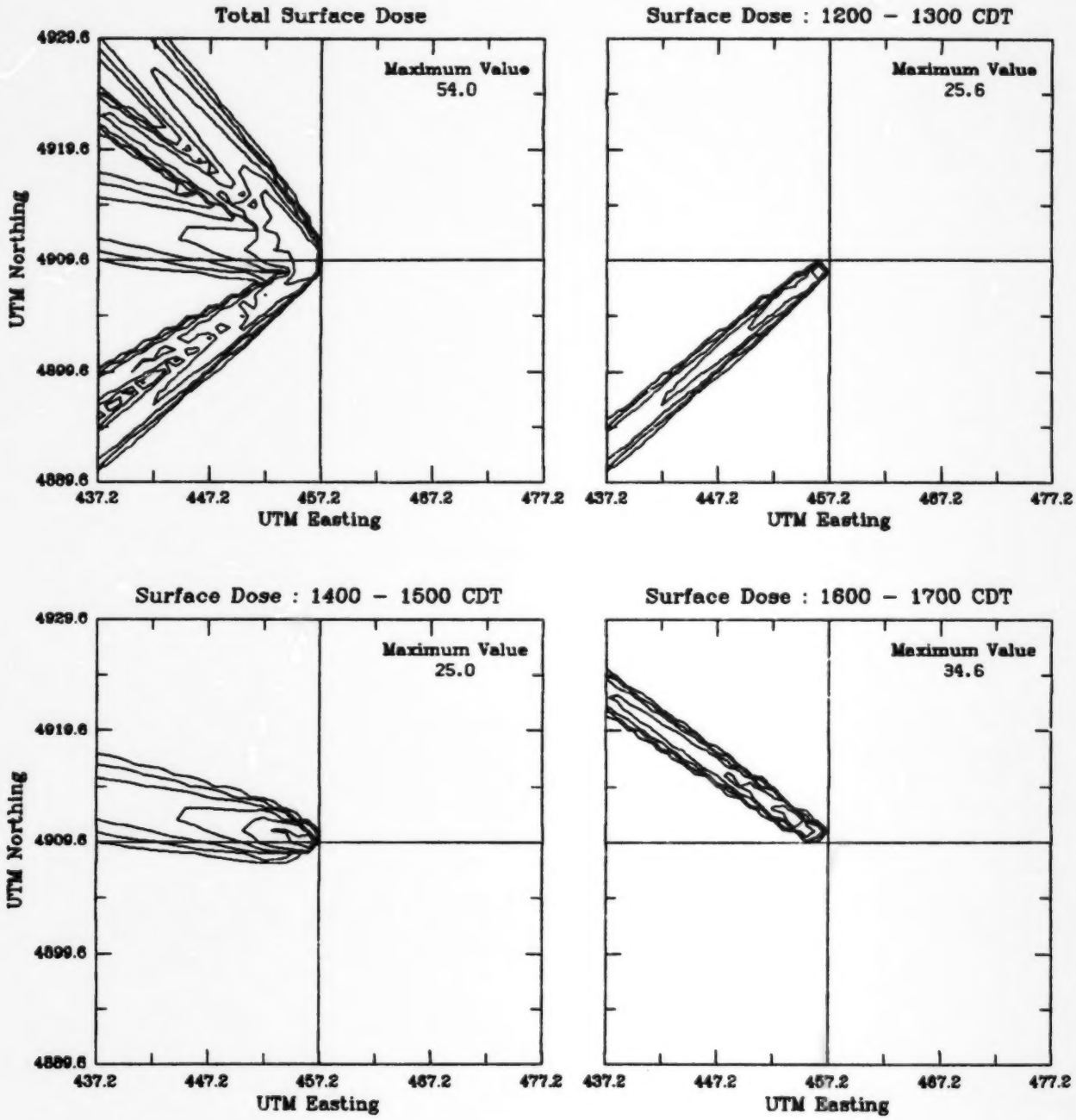


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GLUMP : TEST 3

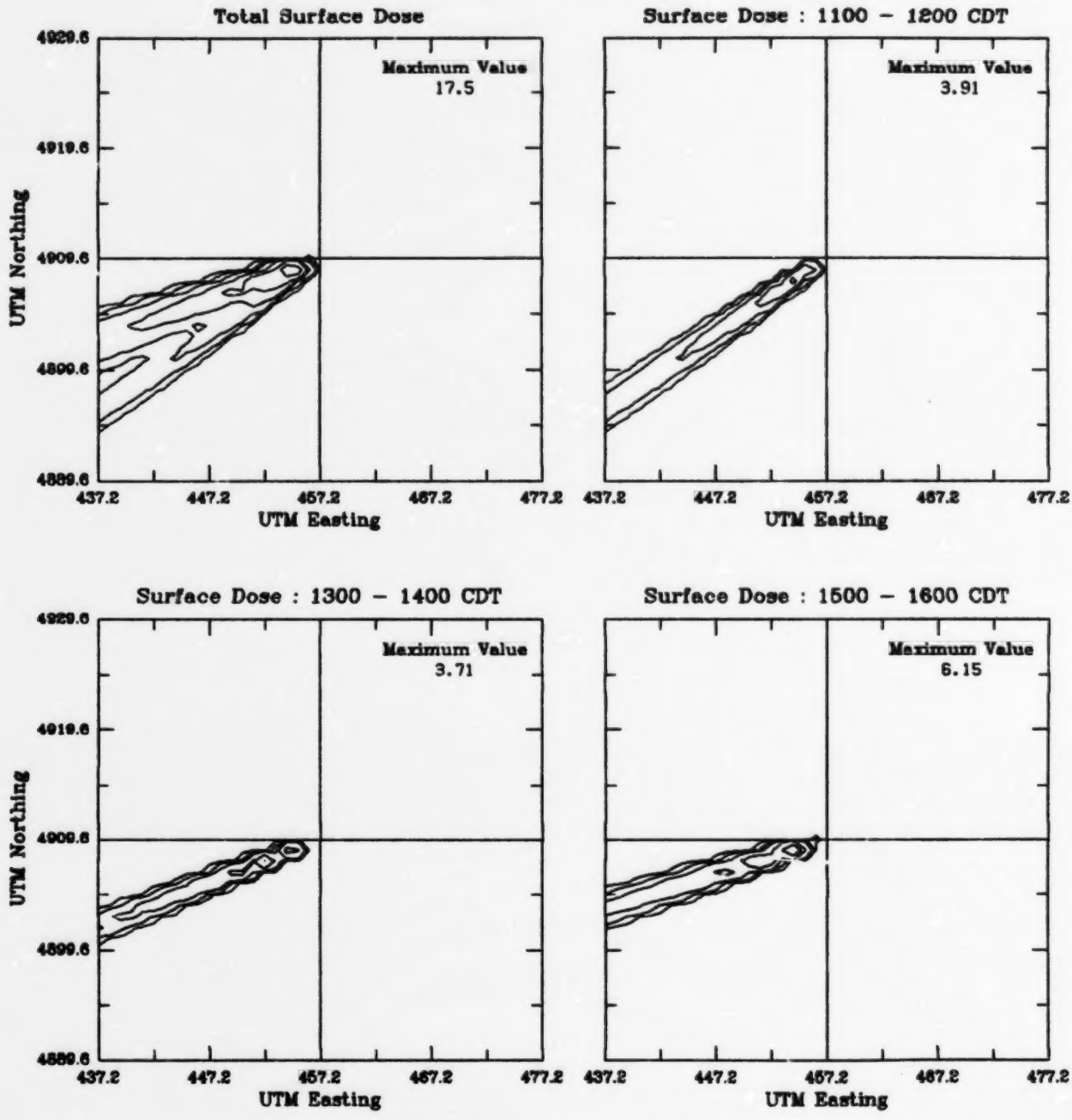


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GLUMP : TEST 4

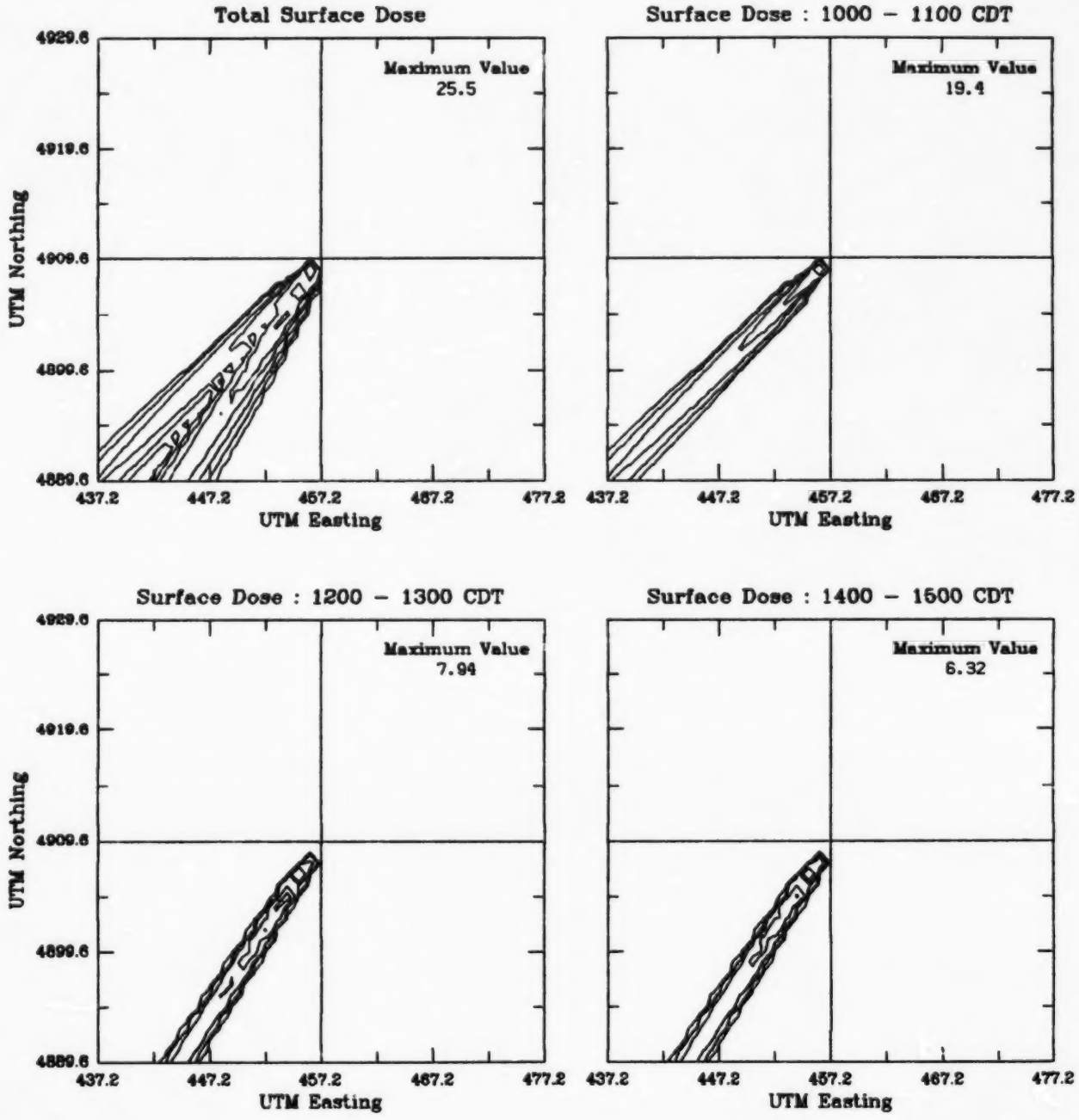


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GLUMP : TEST 5

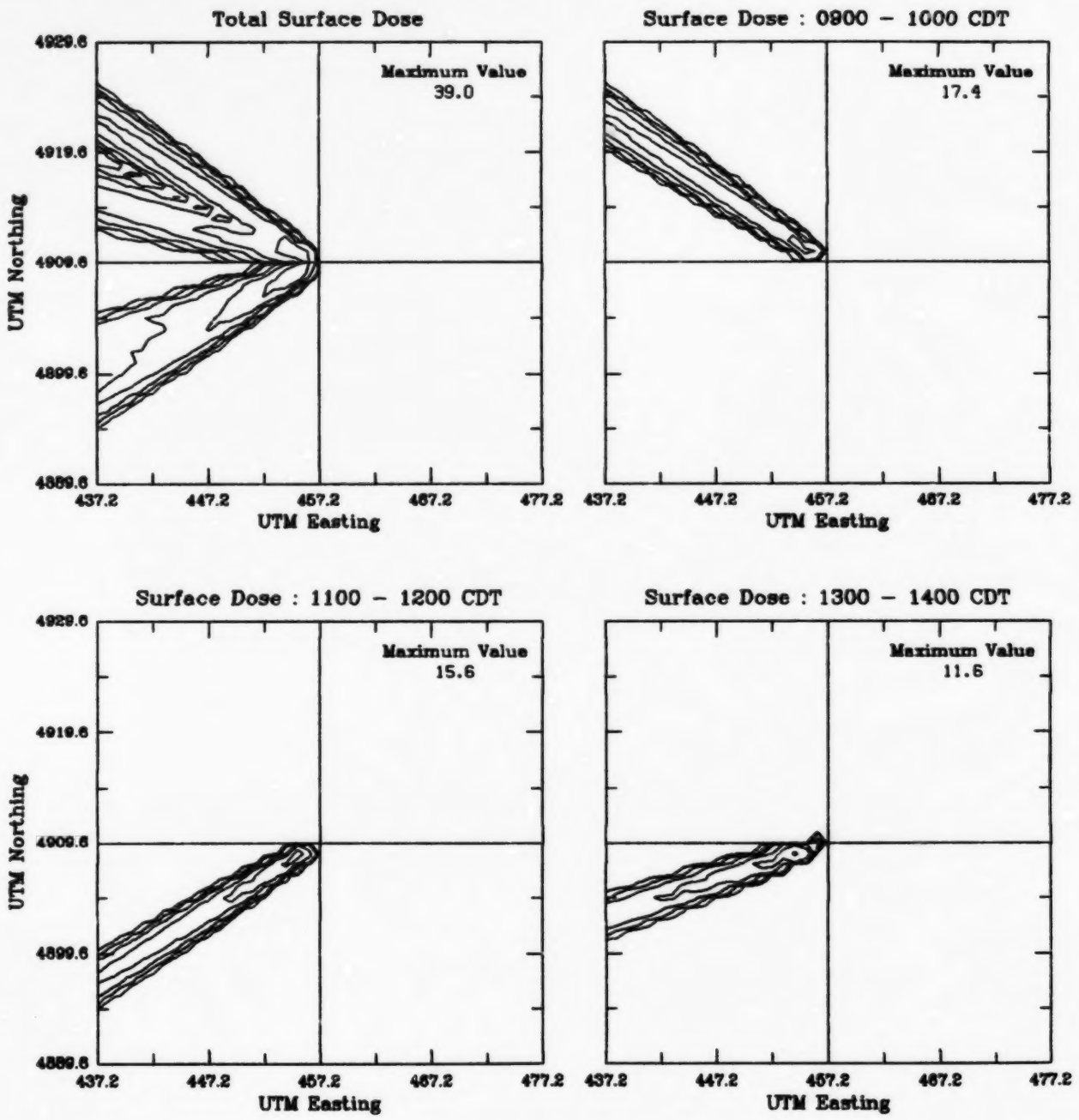


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GLUMP : TEST 6

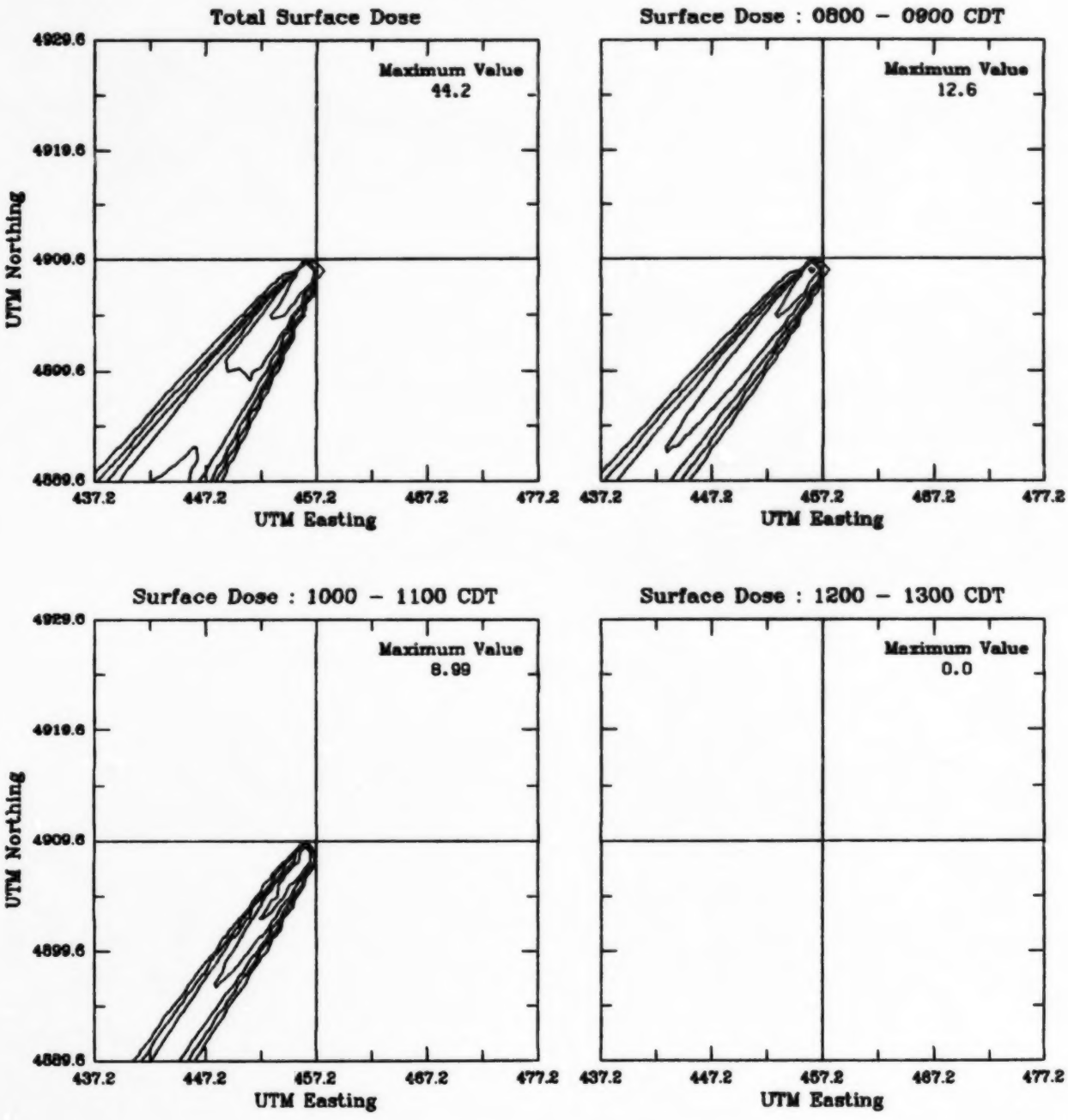


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GLUMP : TEST 7

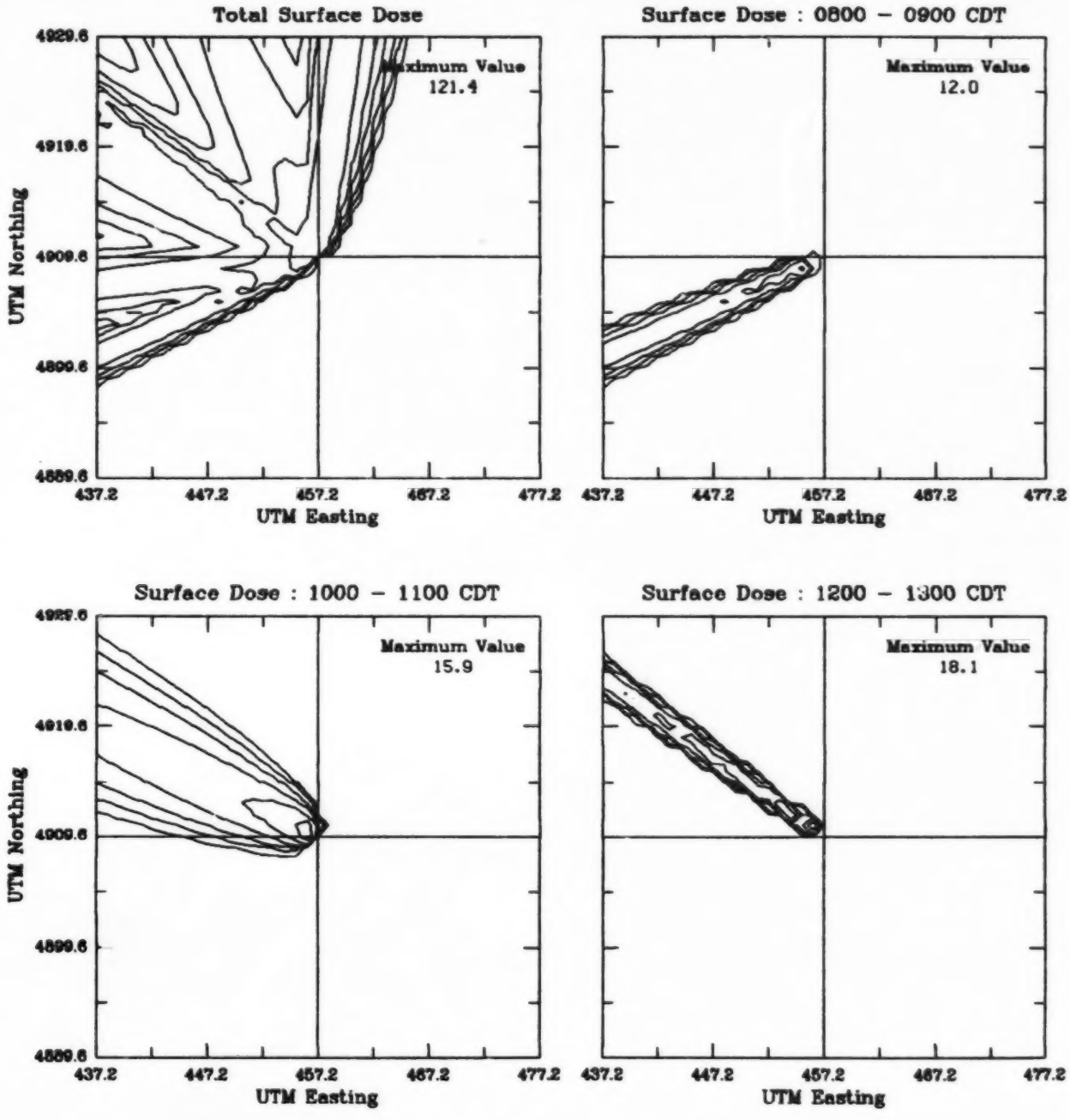


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GLUMP : TEST 8

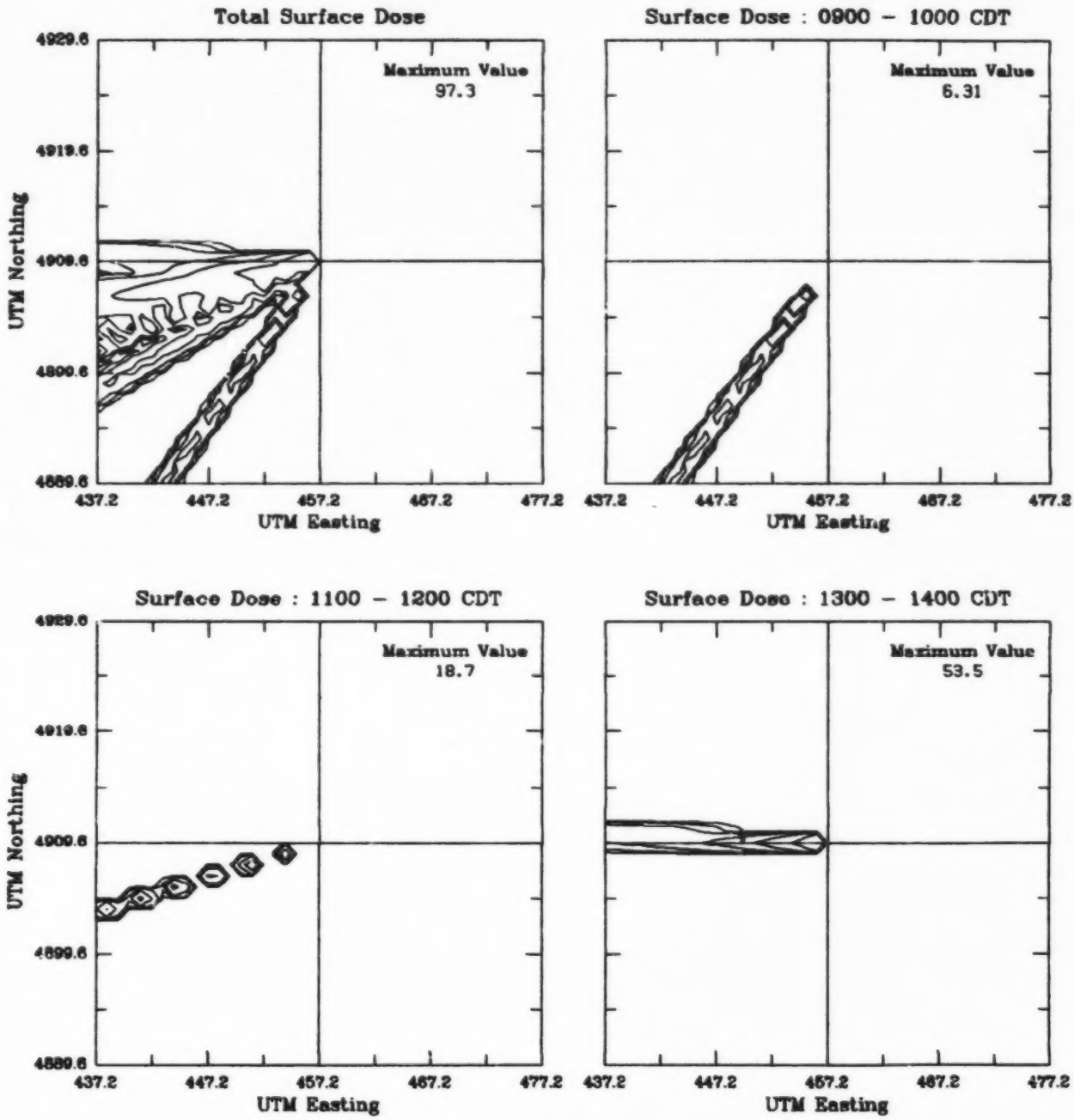


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

GLUMP : TEST 9

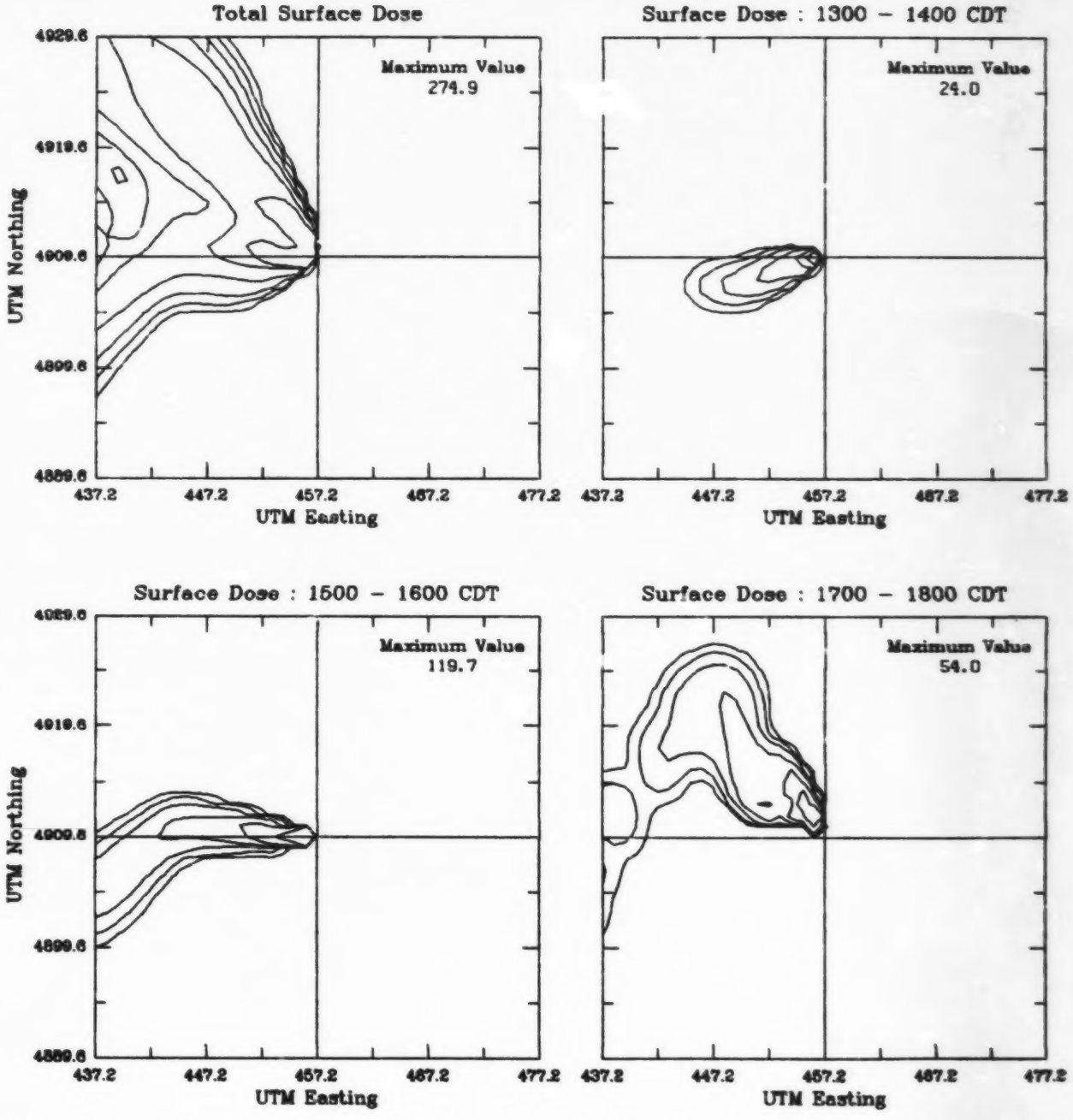


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOI : TEST 1



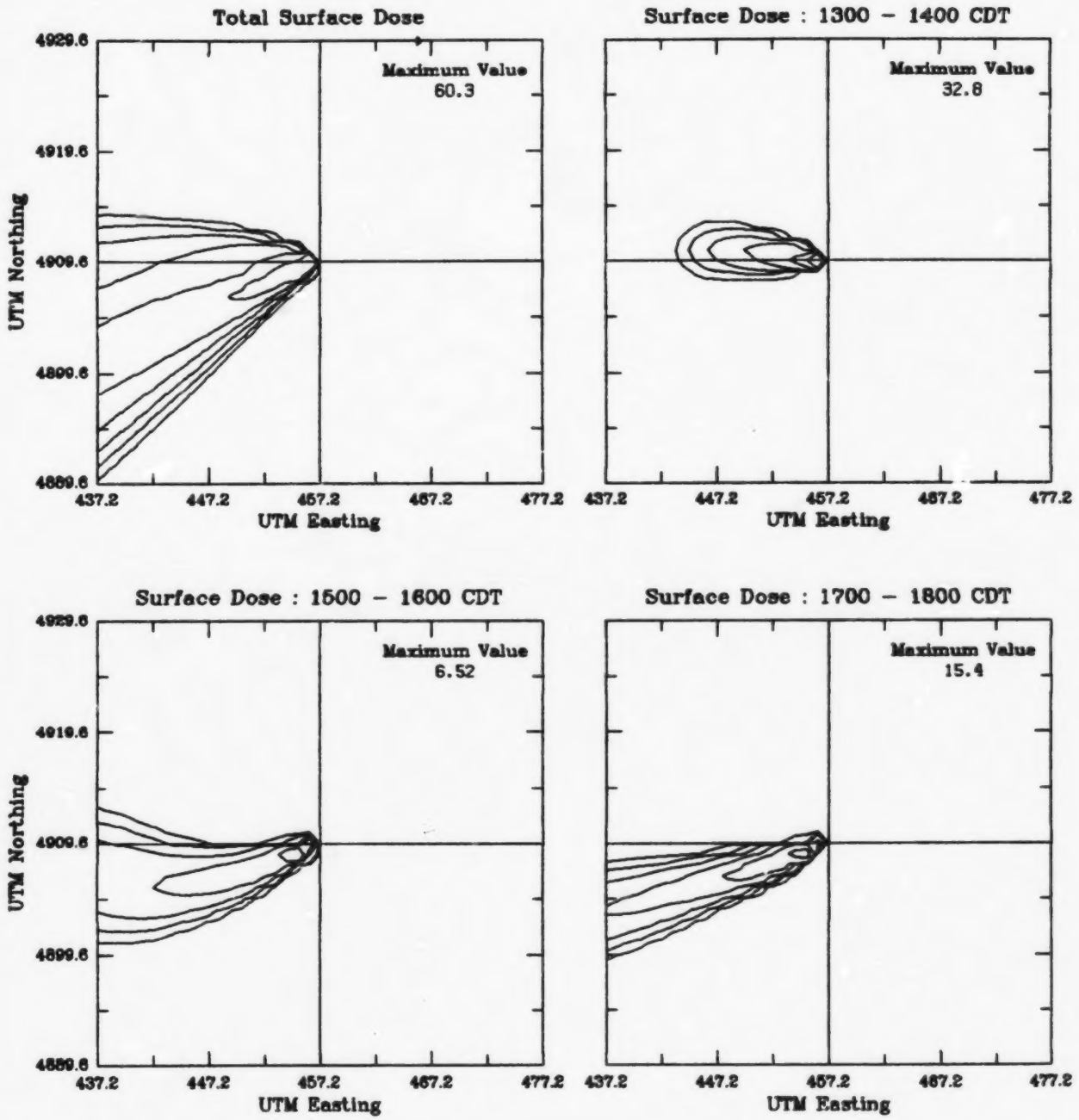
6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

89

MESOI : TEST 2

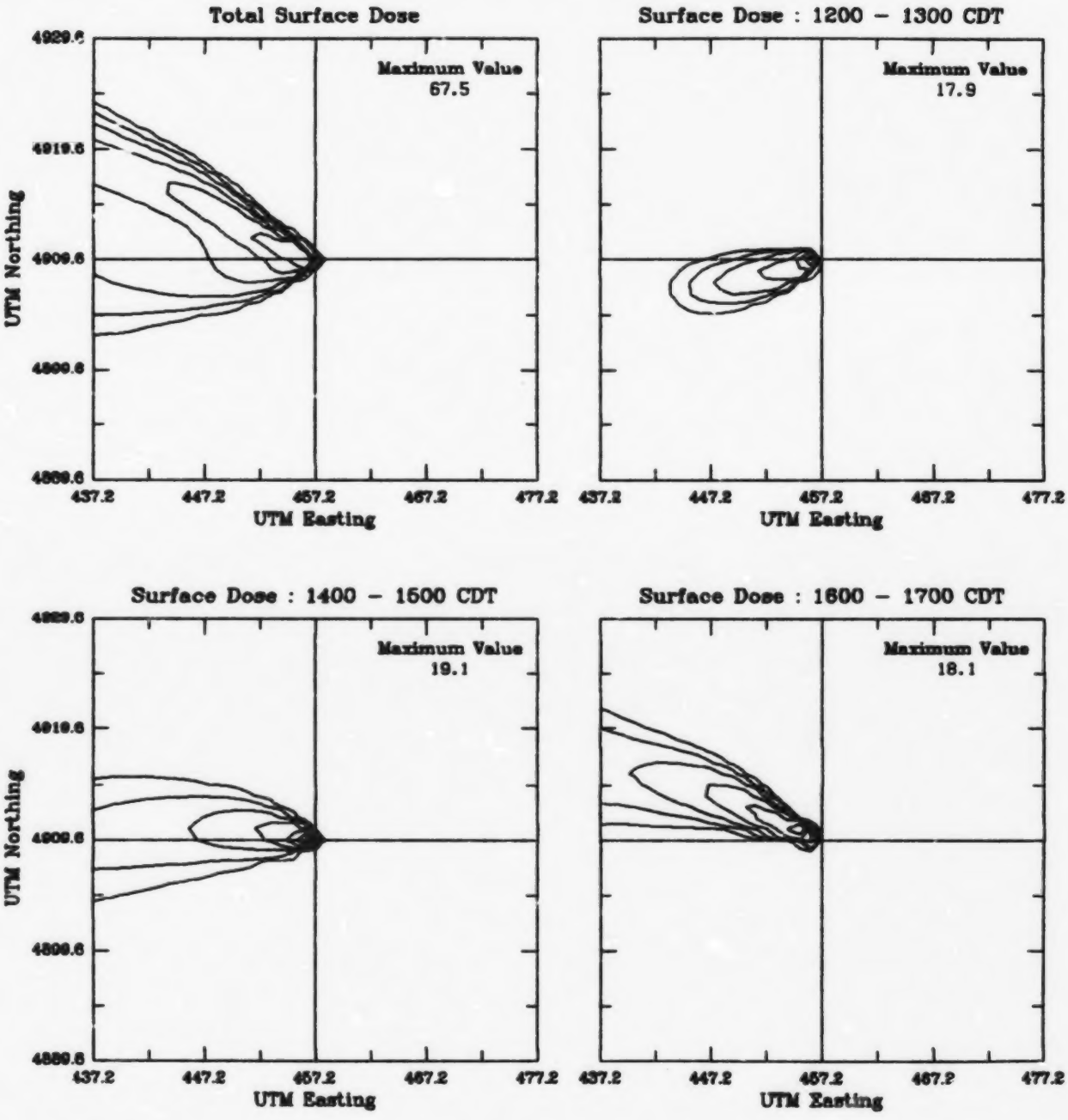


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOI : TEST 3

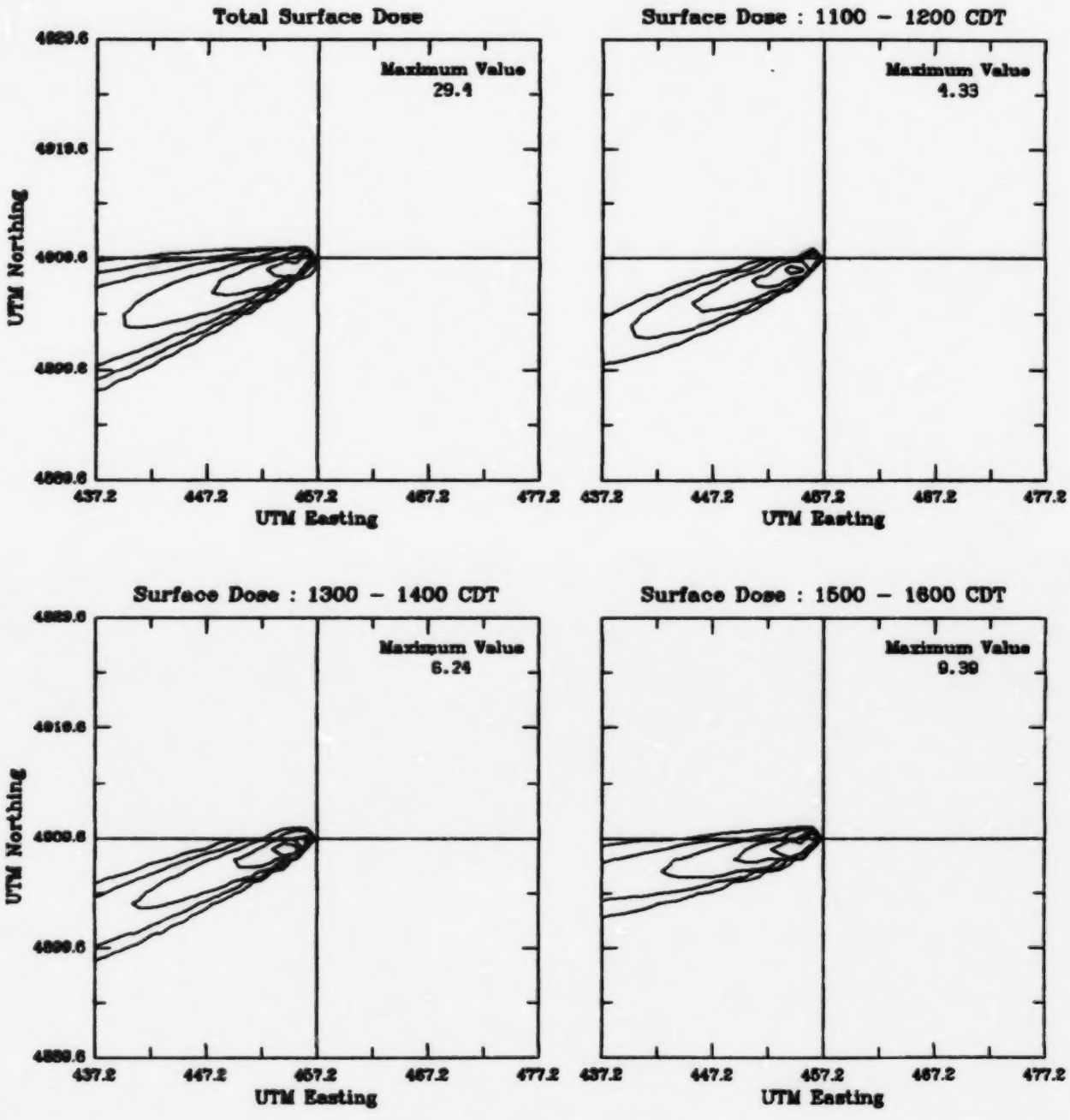


6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

91

BEST COPY AVAILABLE

MESOI : TEST 4

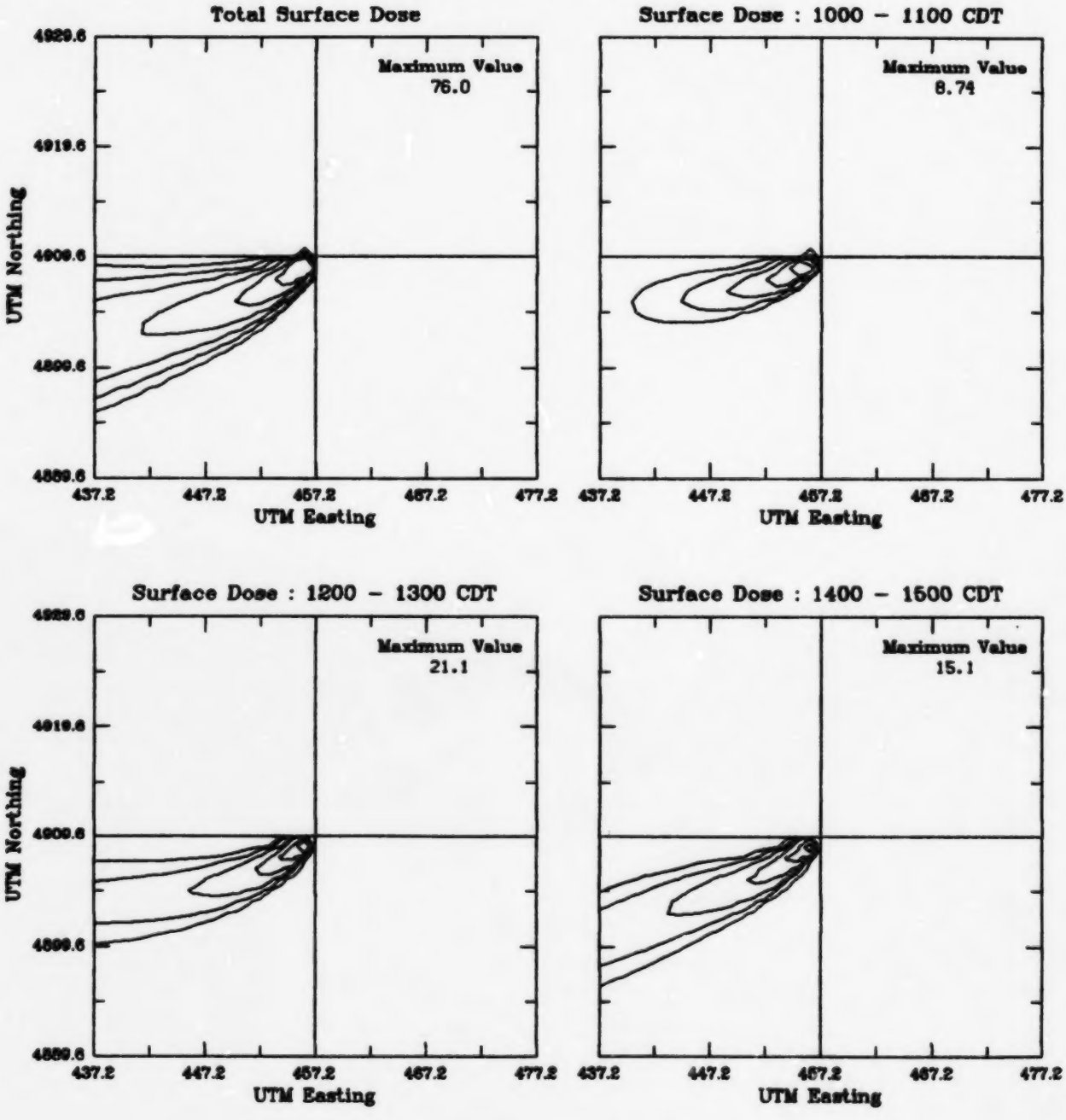


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

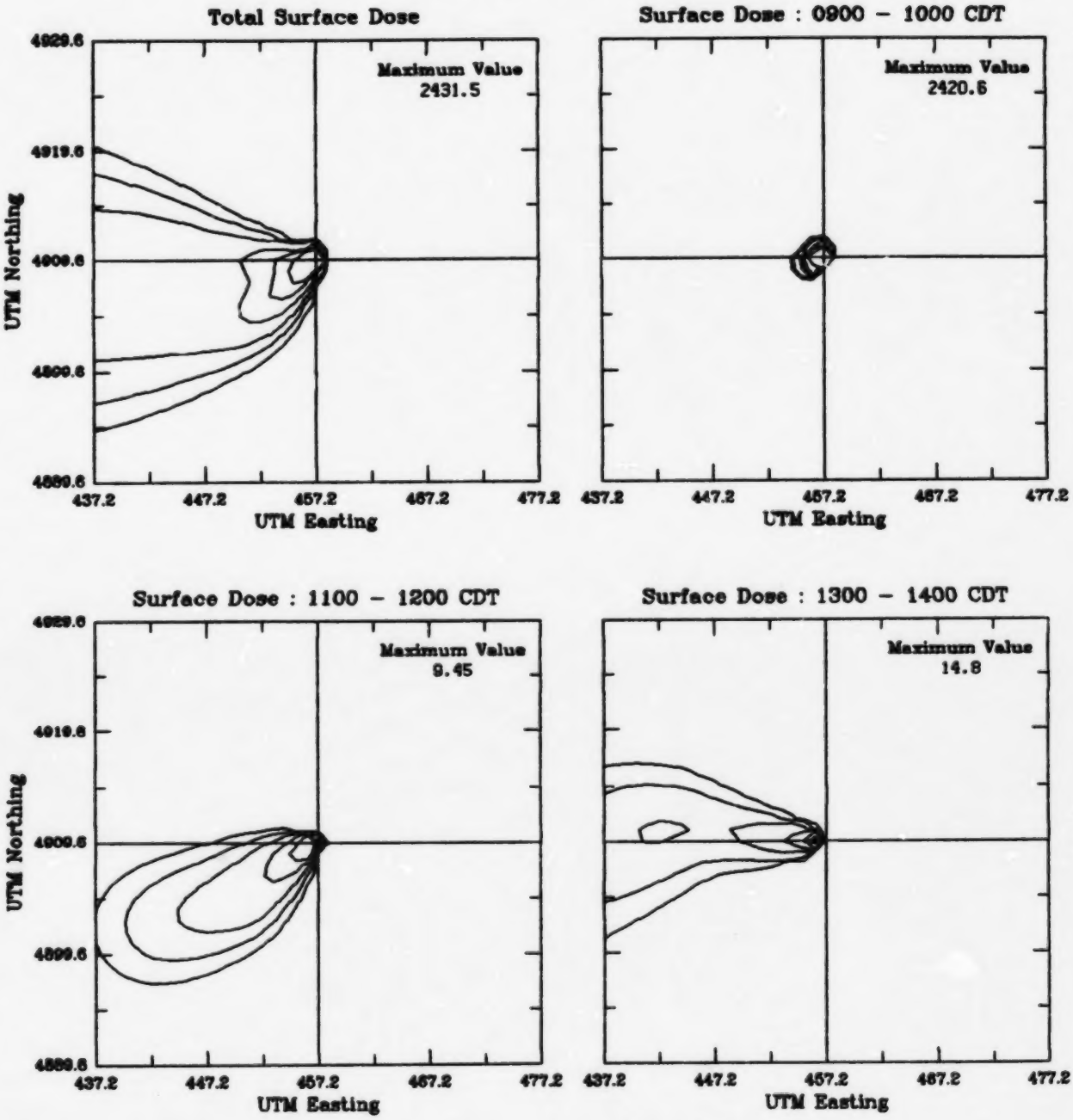
MESOI : TEST 5



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOI : TEST 6

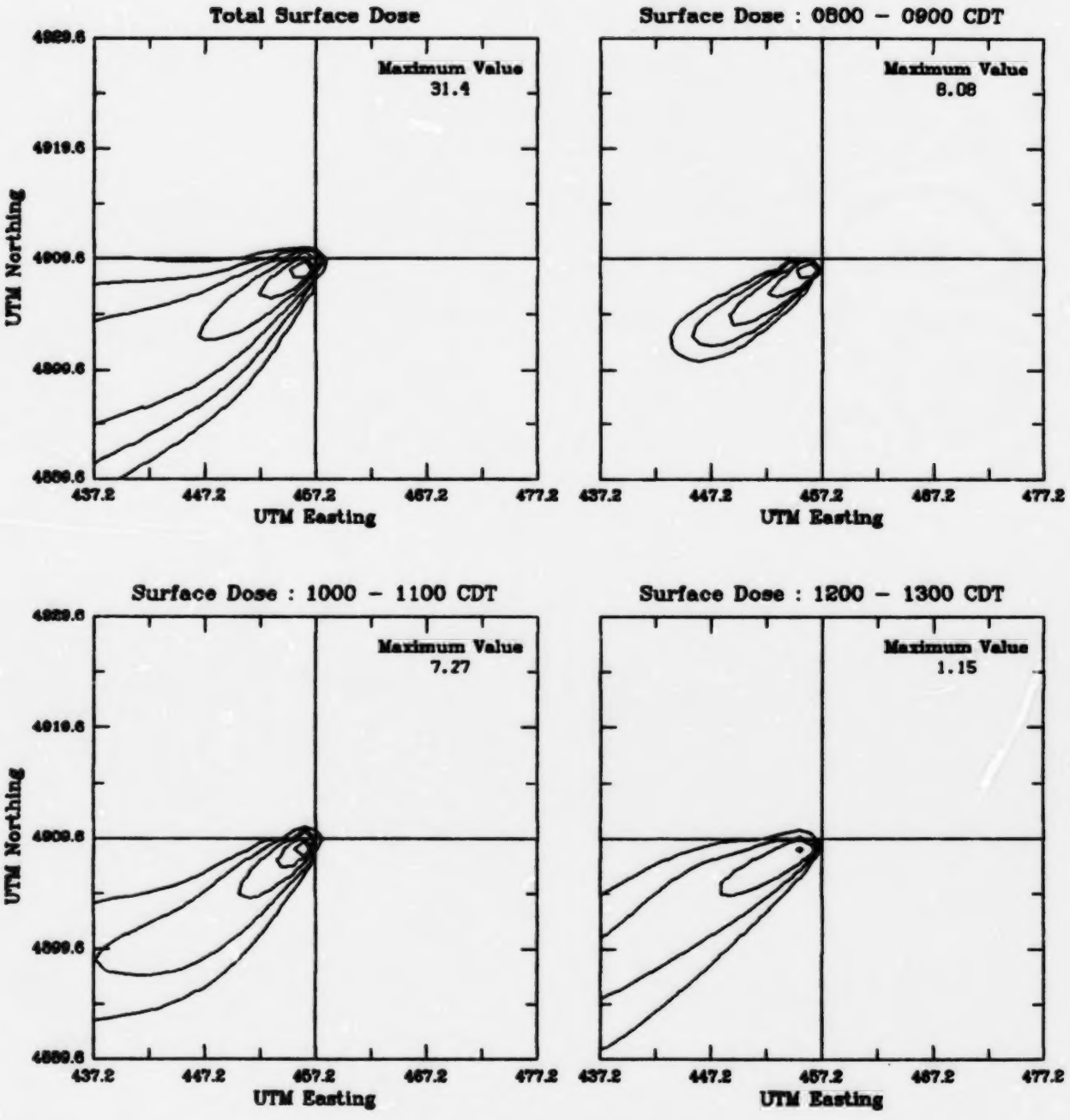


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOI : TEST 7

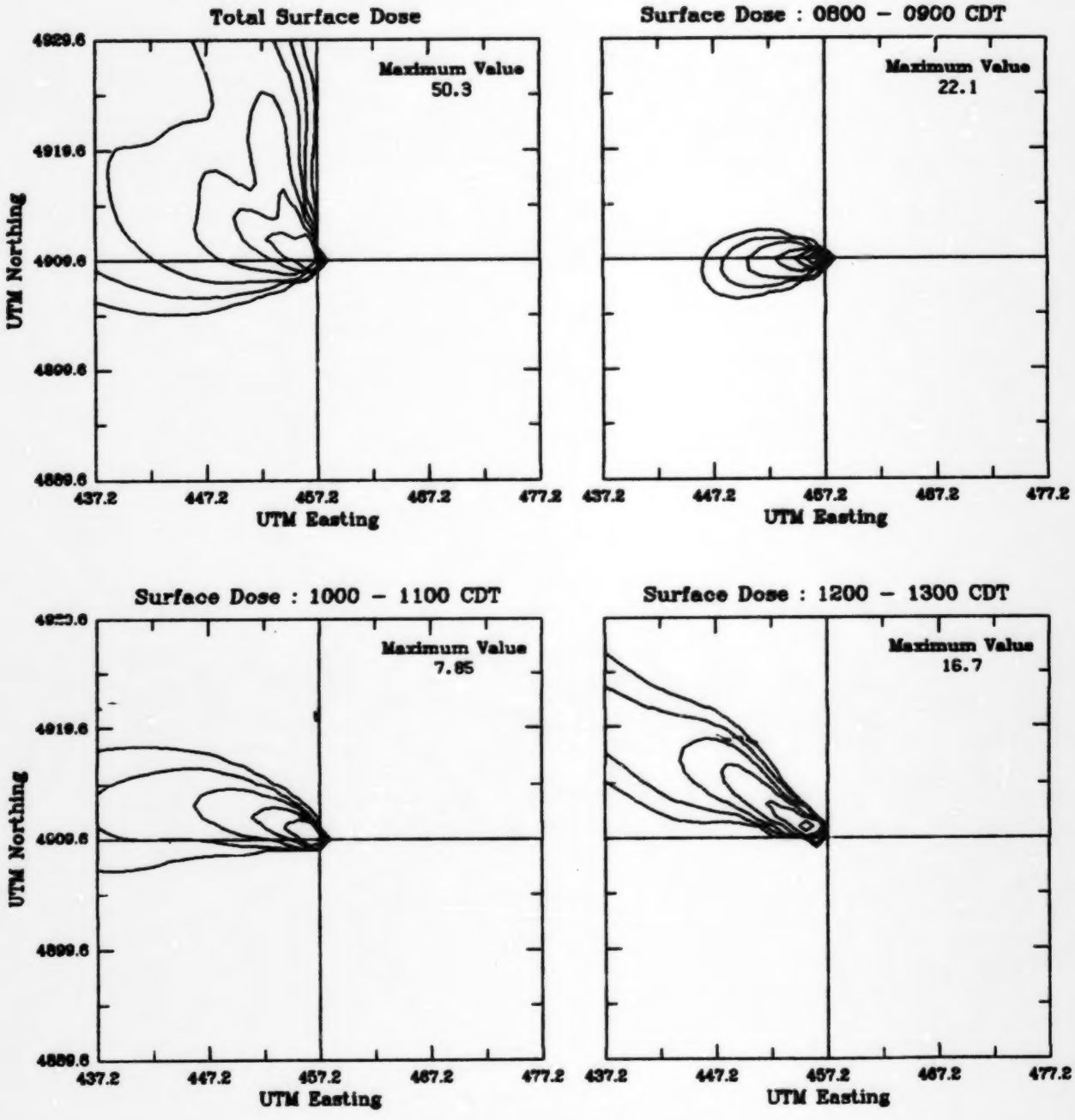


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOI : TEST 8

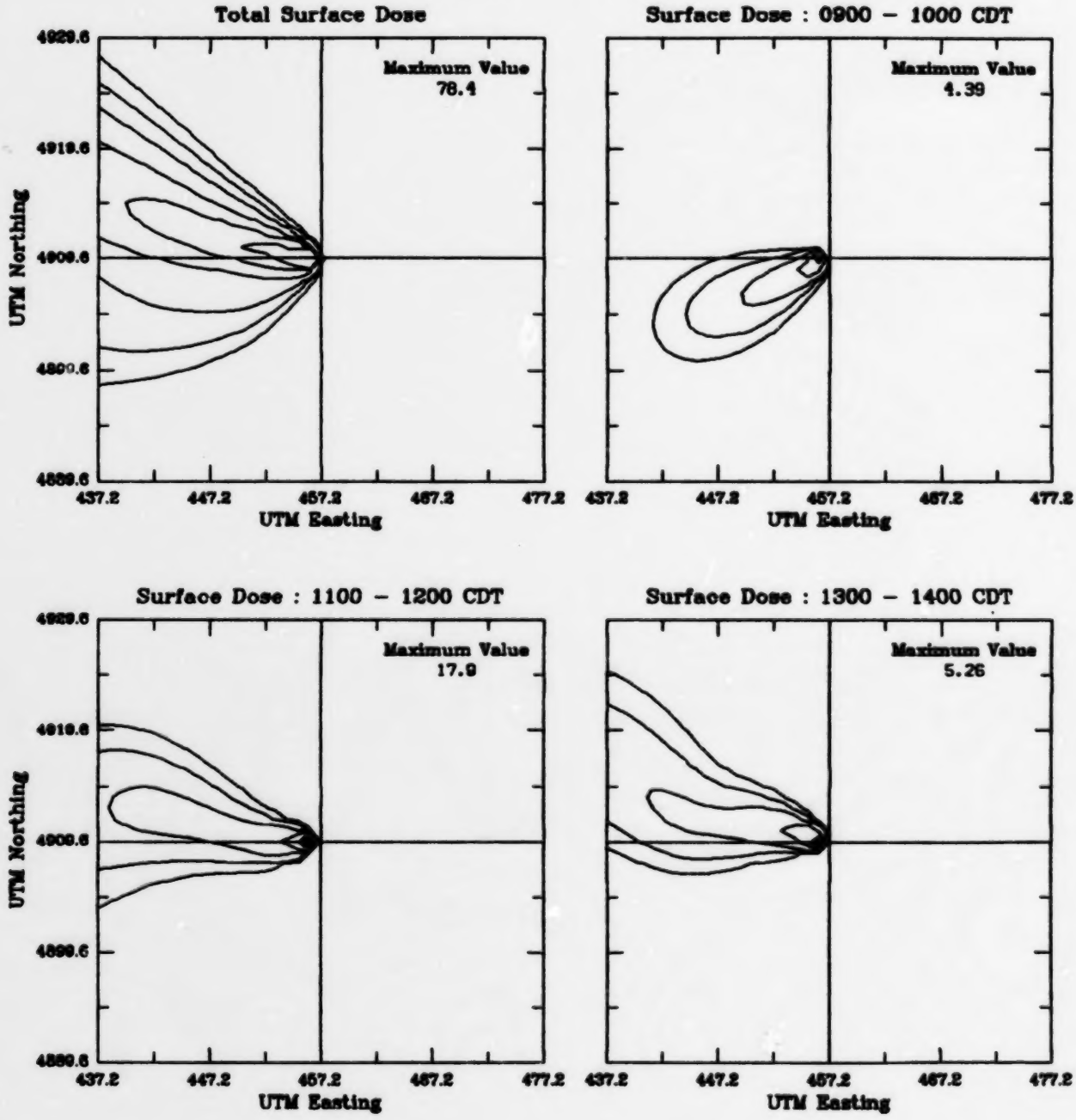


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOI : TEST 9

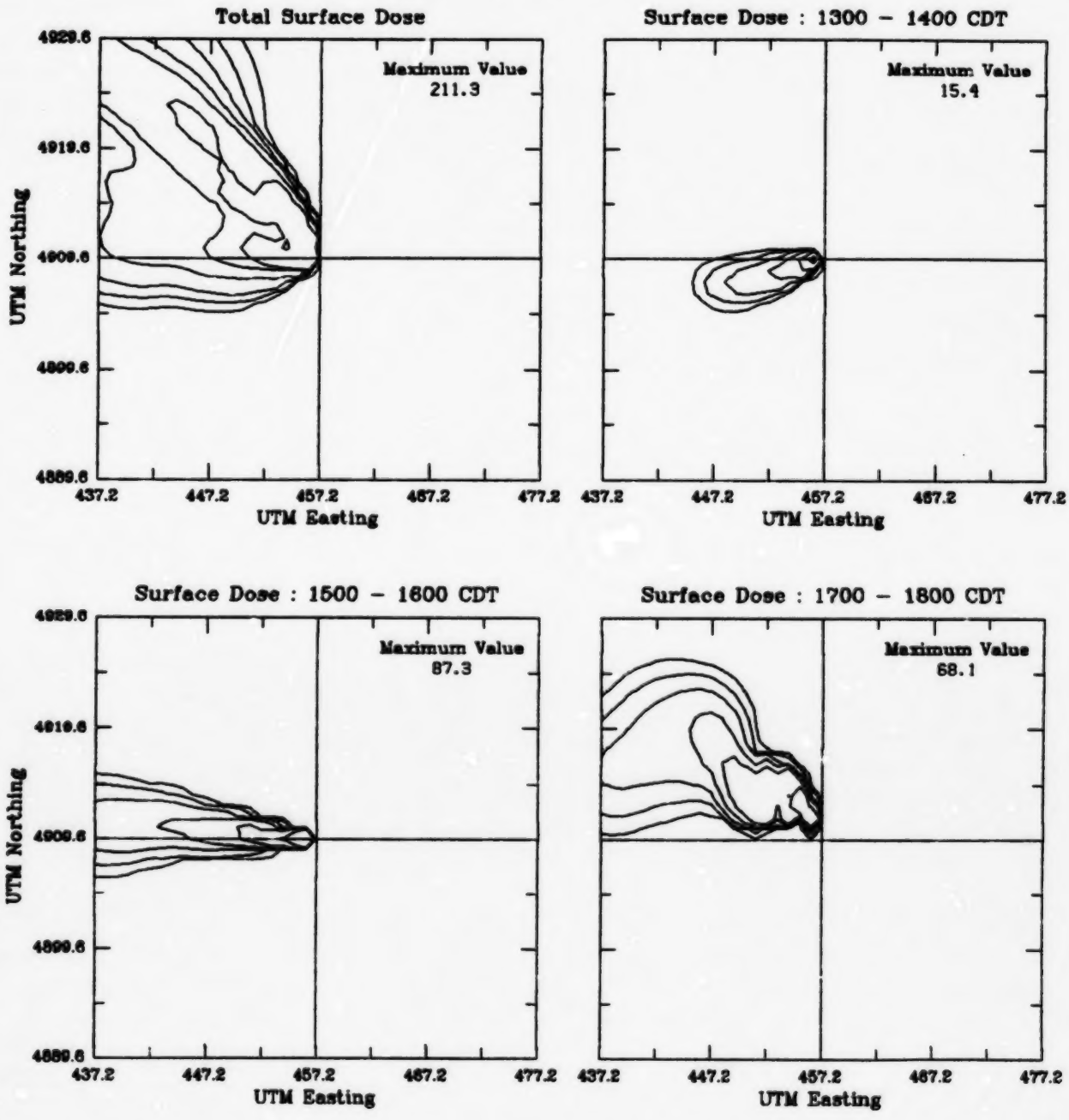


6 Contours : (PPM–Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOI v2 : TEST 1

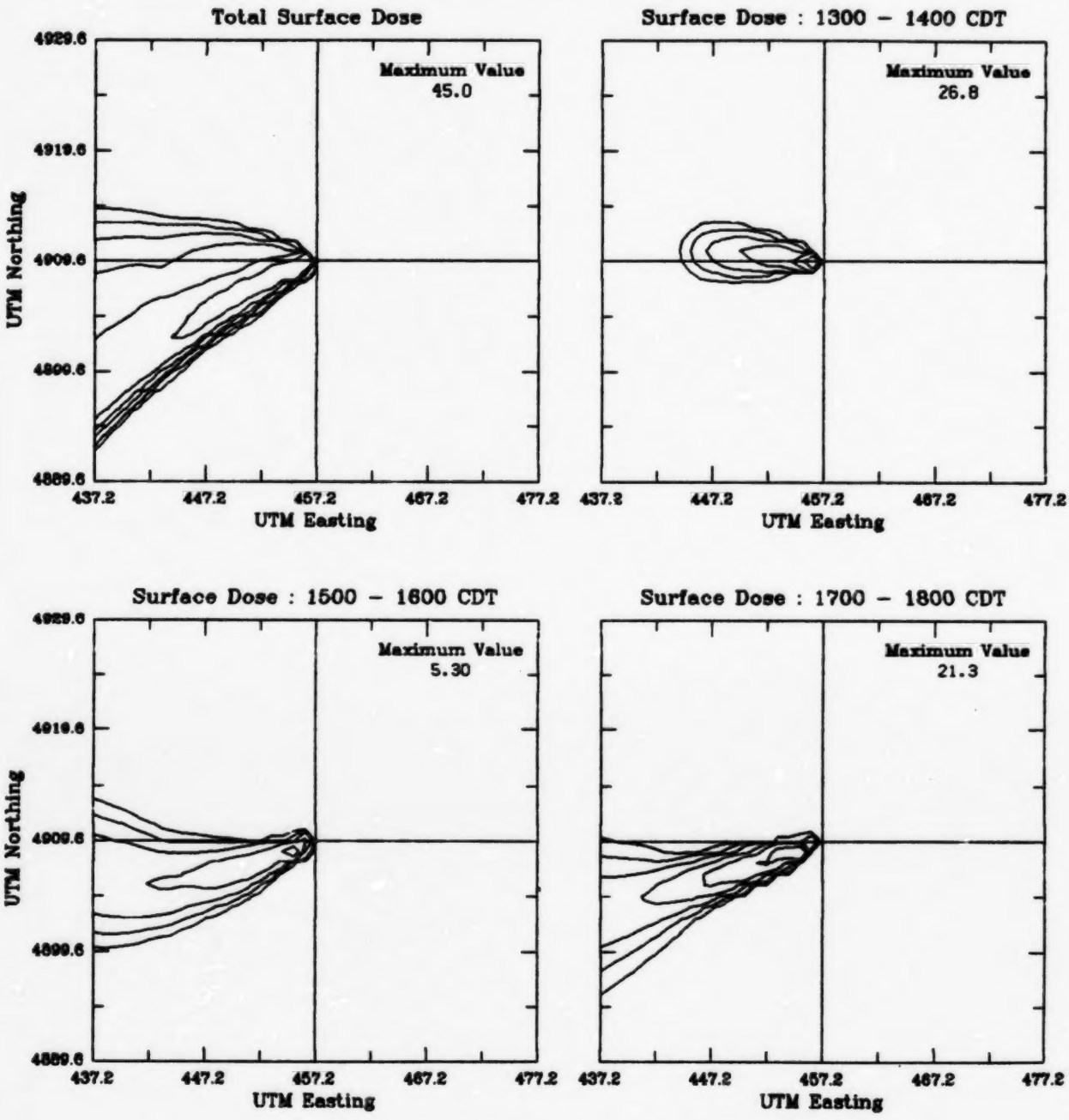


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

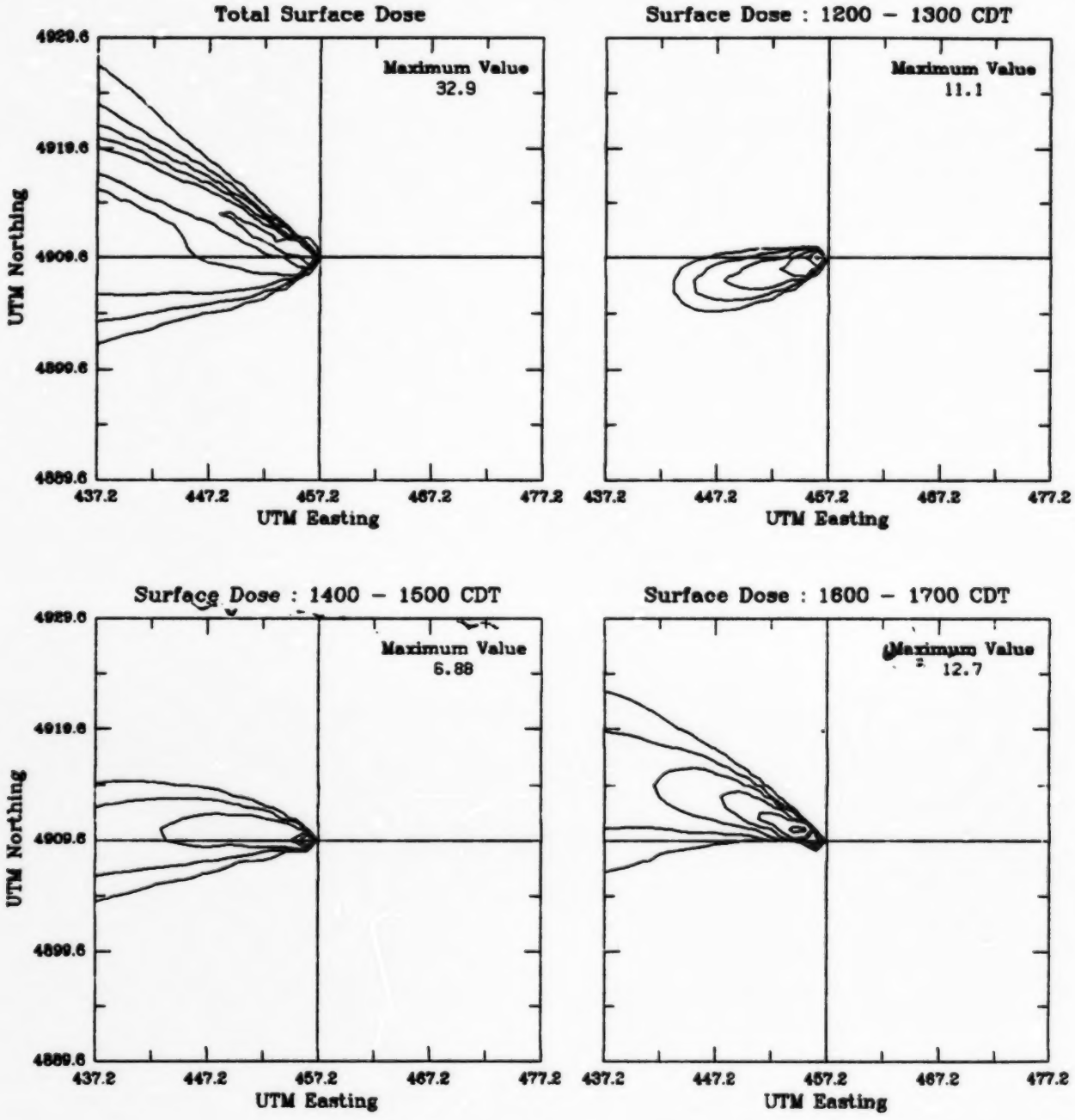
MESOI v2 : TEST 2



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOI v2 : TEST 3

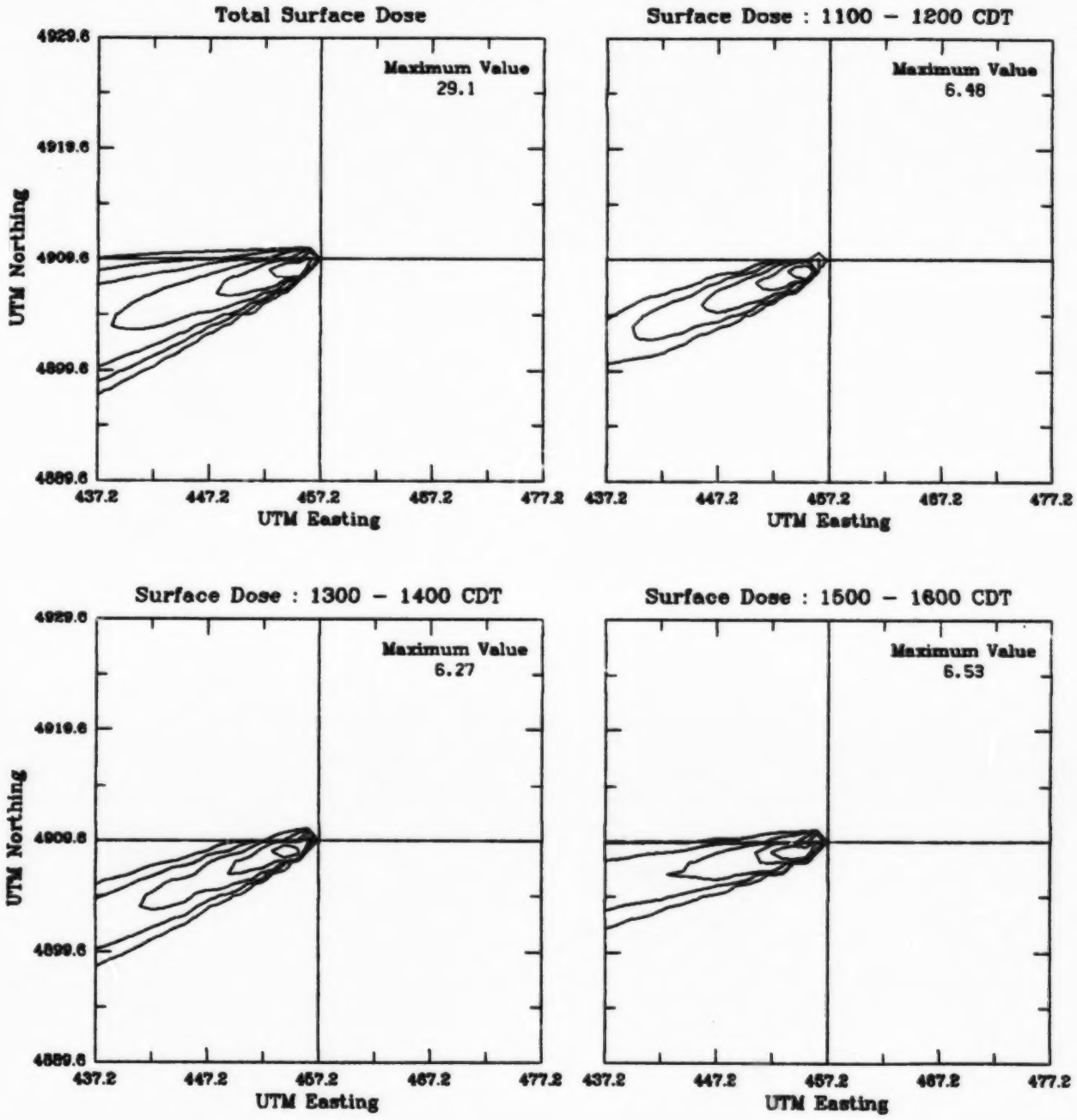


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

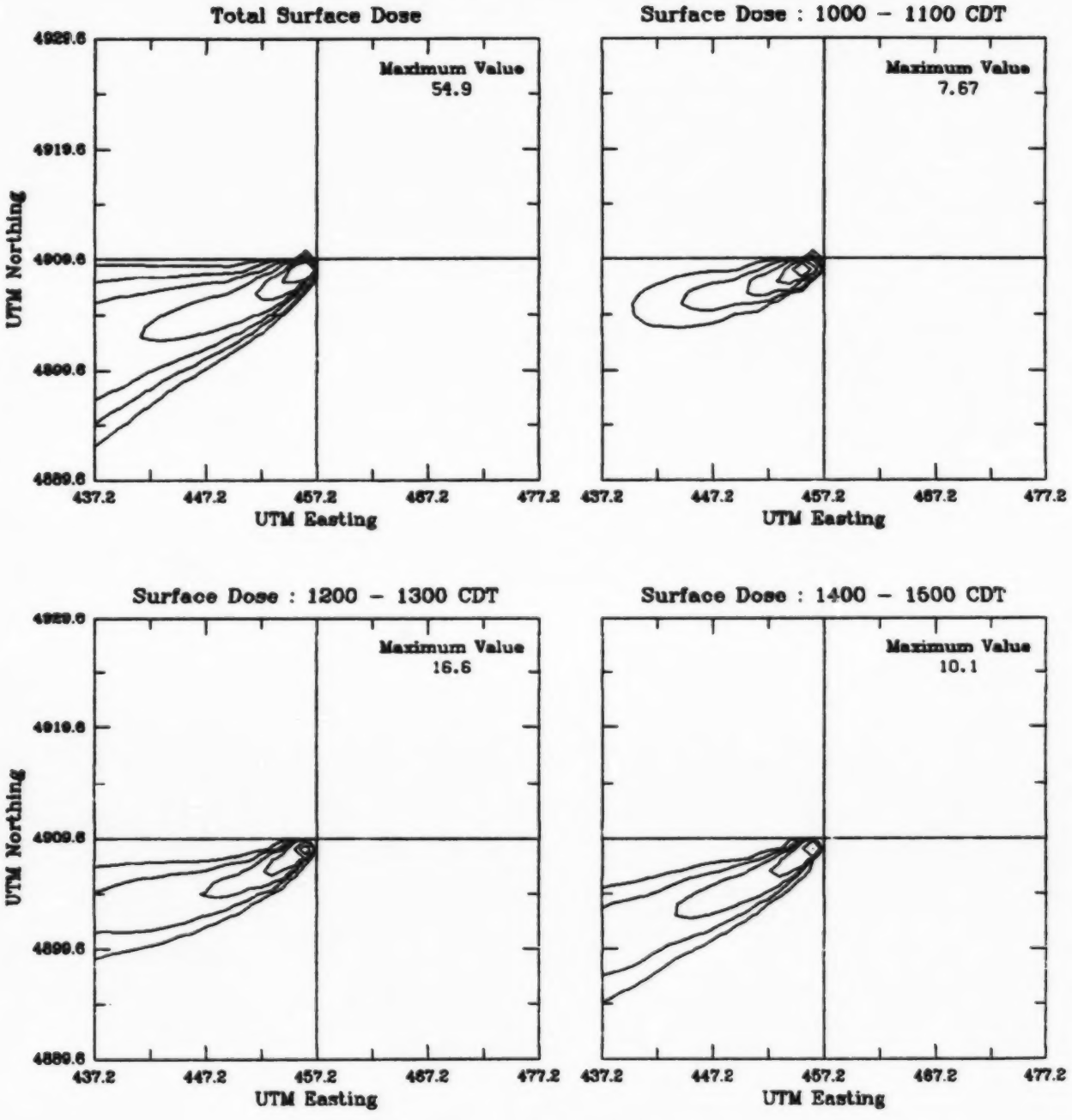
MESOI v2 : TEST 4



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOI v2 : TEST 5

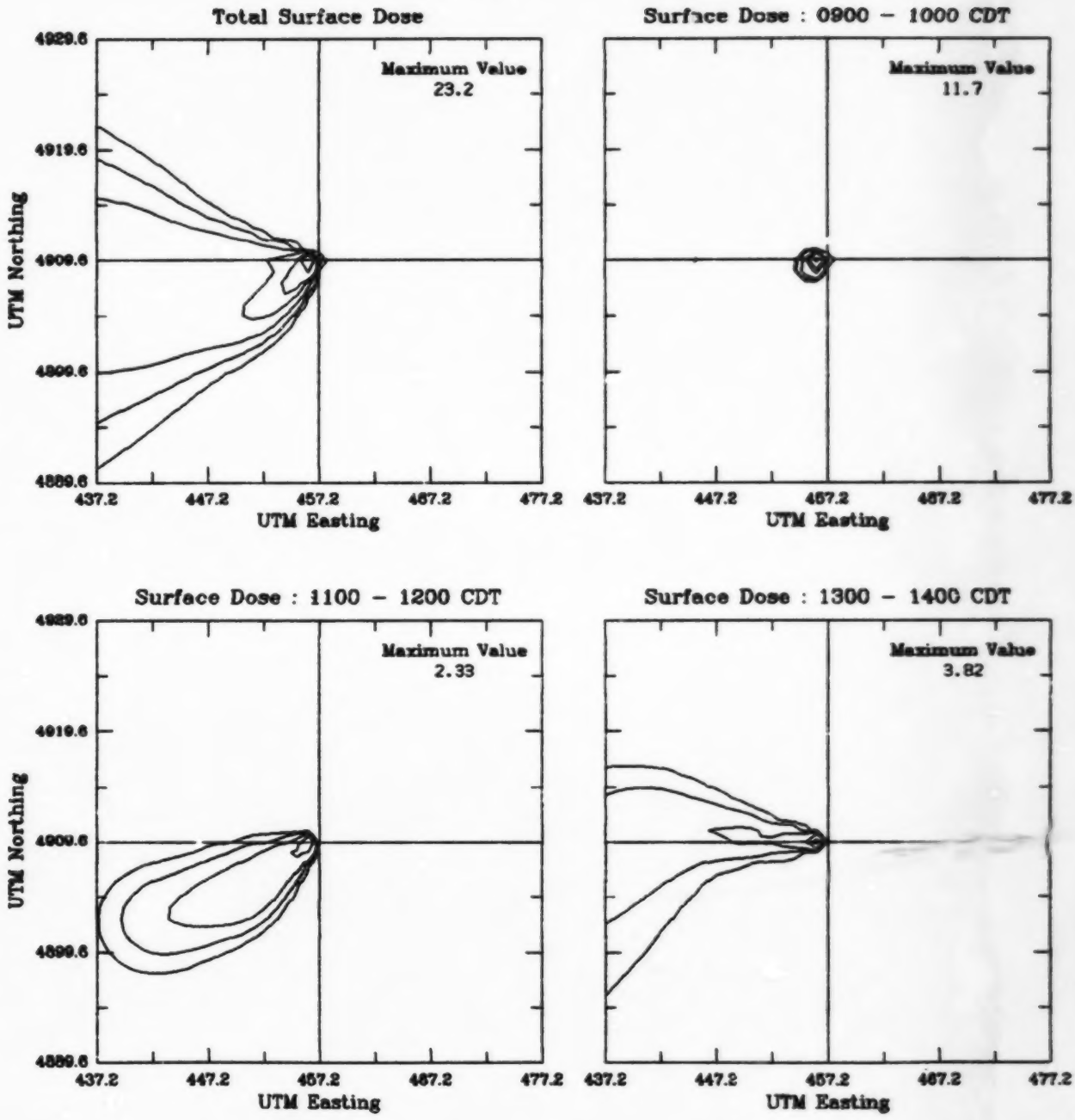


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

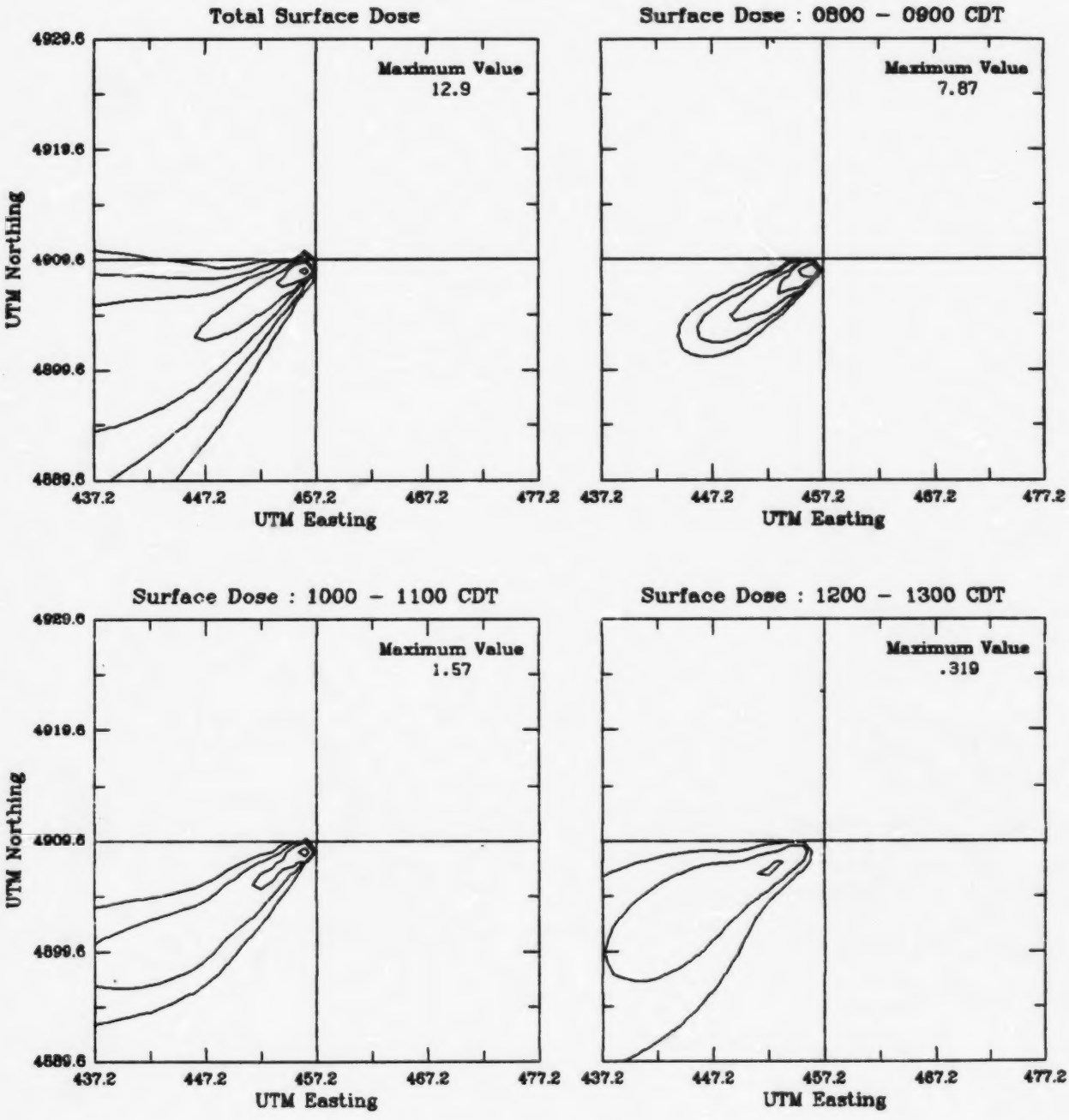
MESOI v2 : TEST 6



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOI v2 : TEST 7

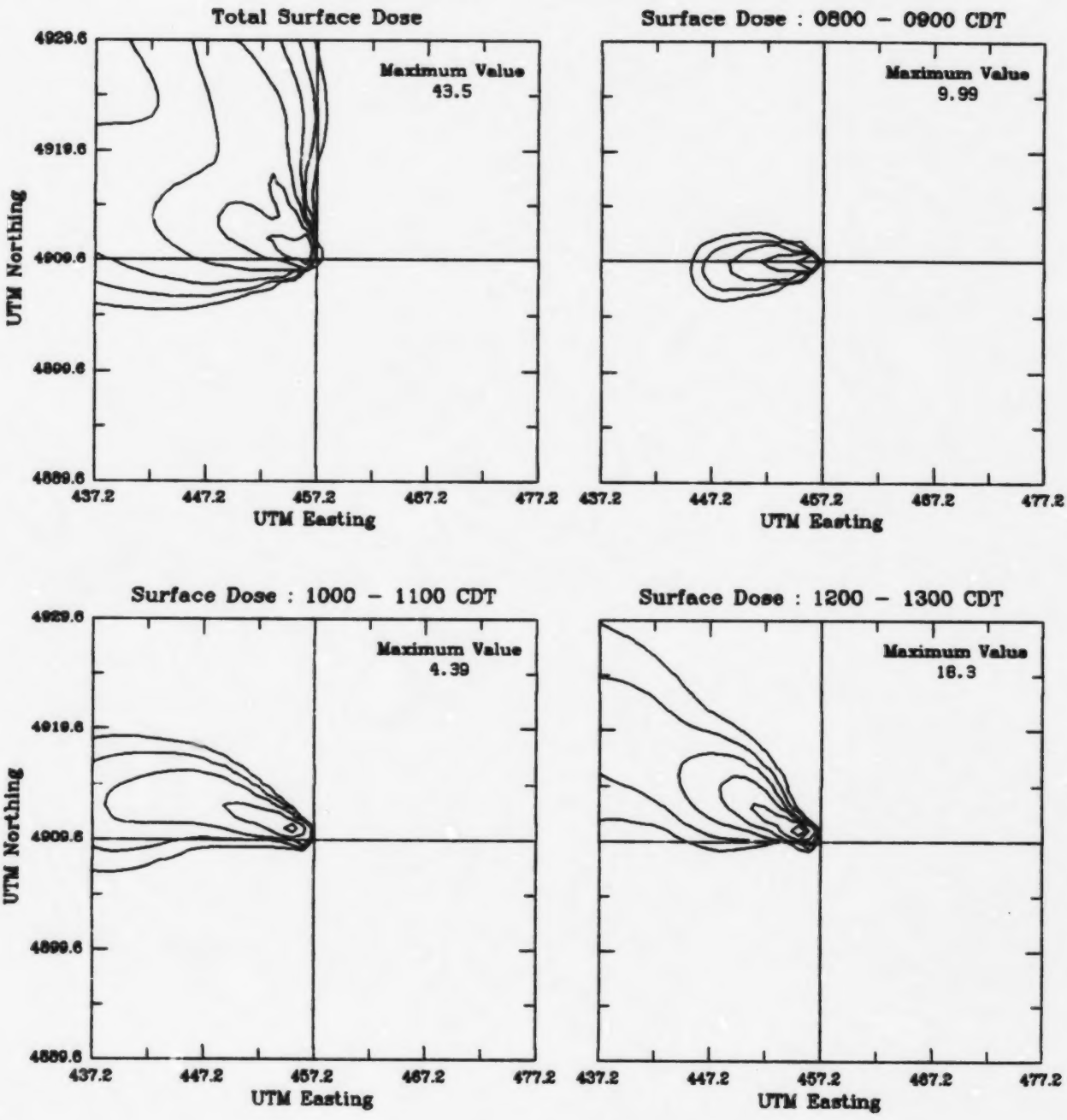


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOI v2 : TEST 8

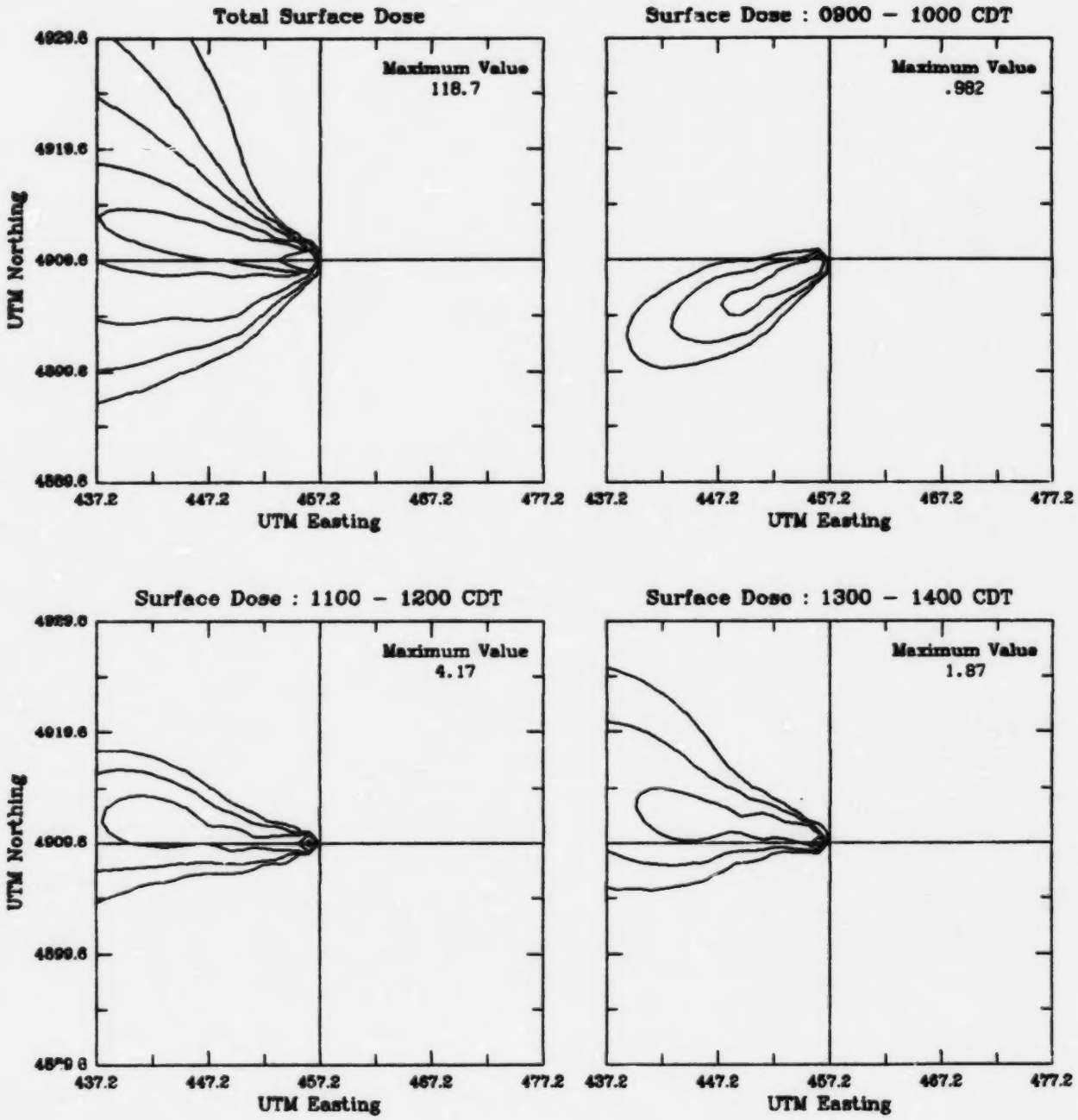


6 Contours : (PPM–Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

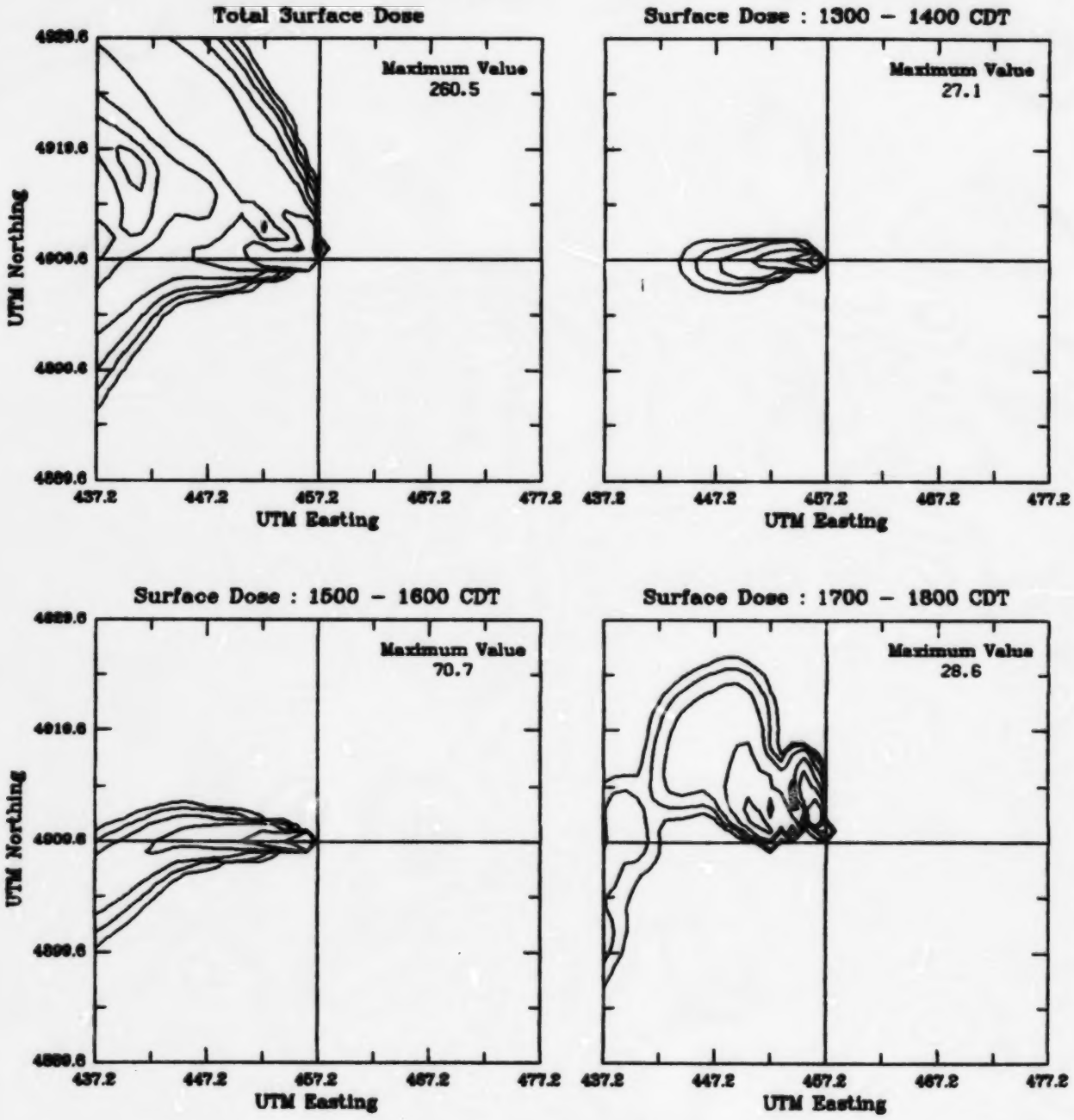
MESOI v2 : TEST 9



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOJ : TEST 1

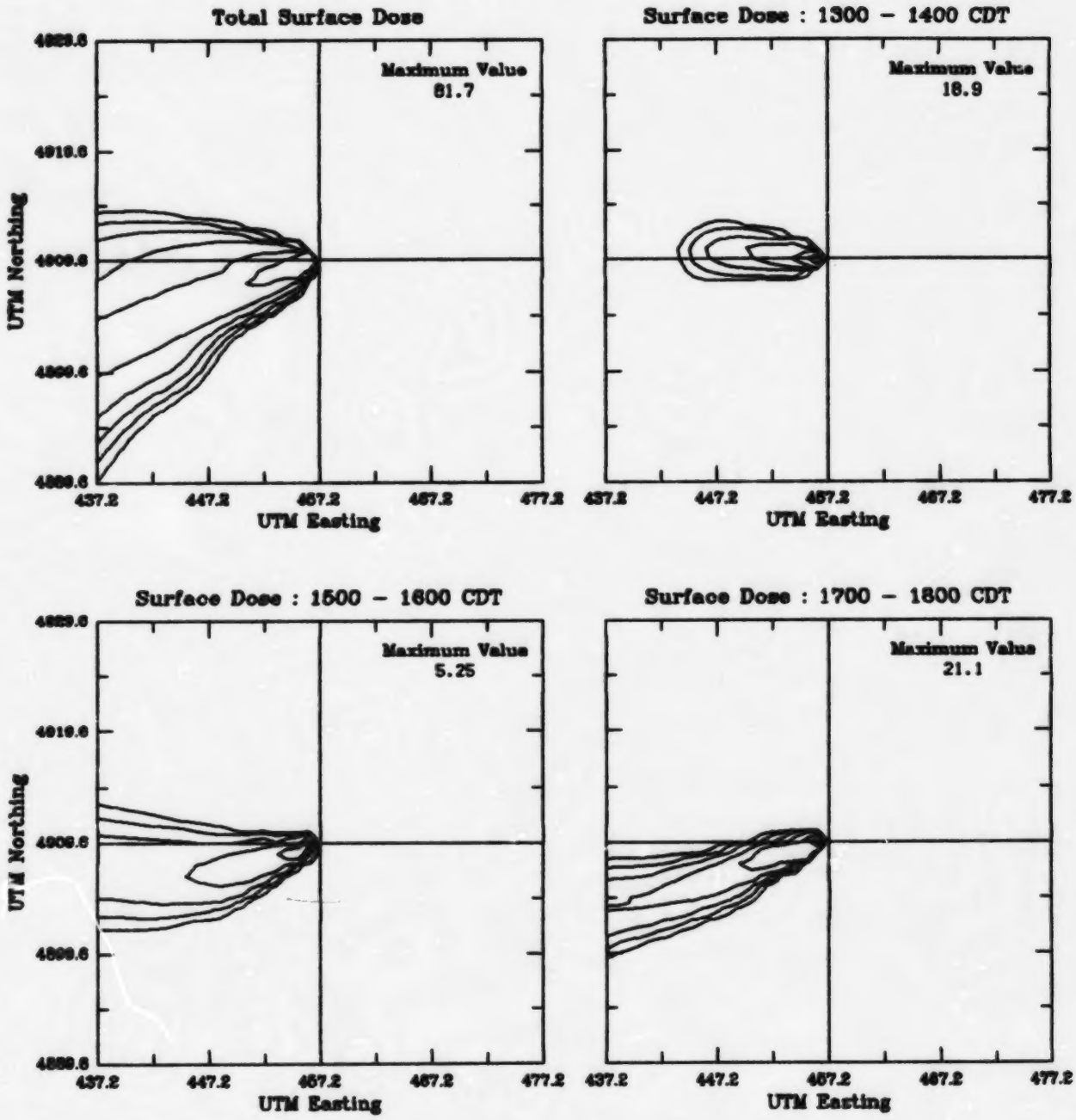


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

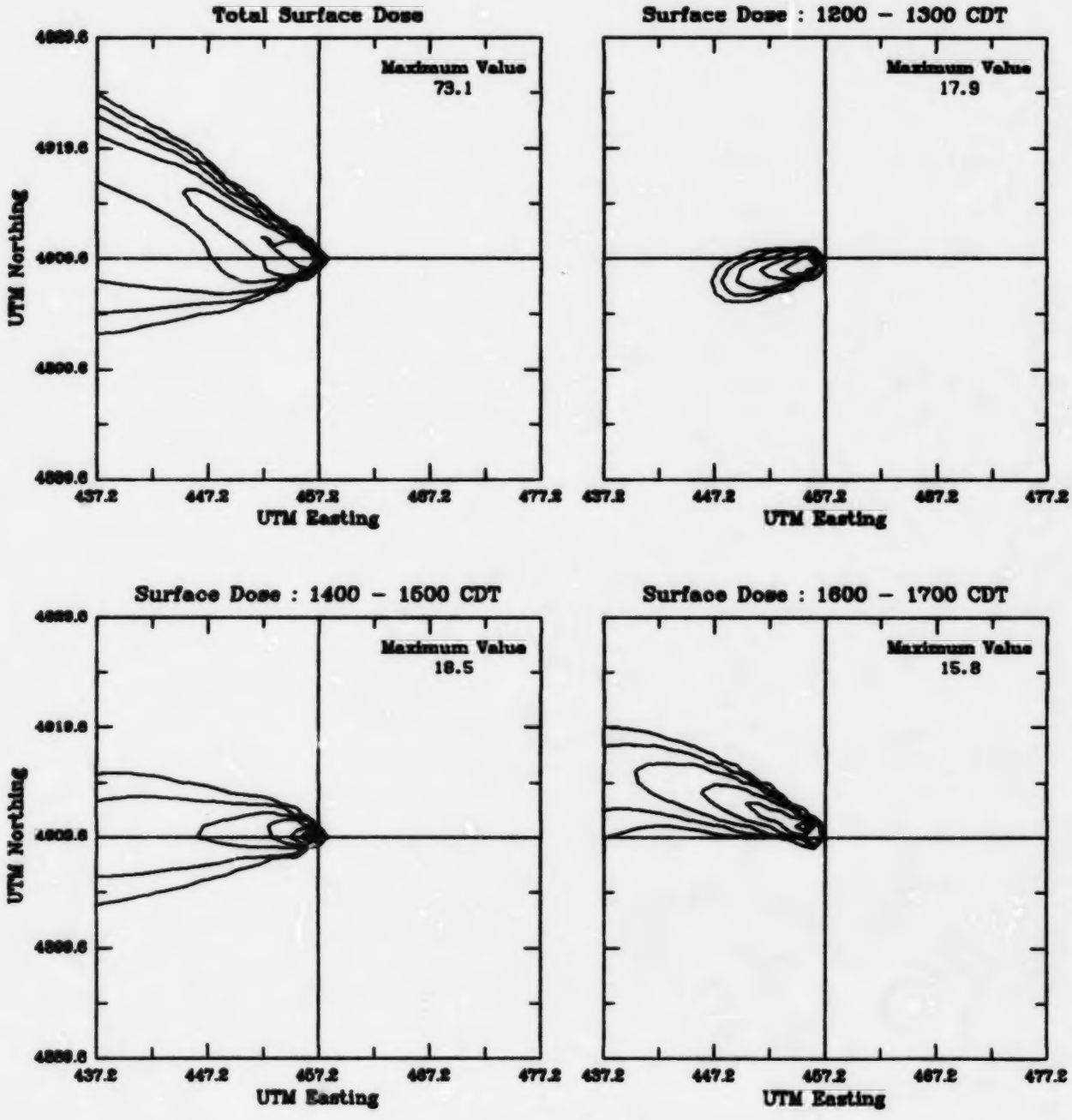
MESOJ : TEST 2



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOJ : TEST 3

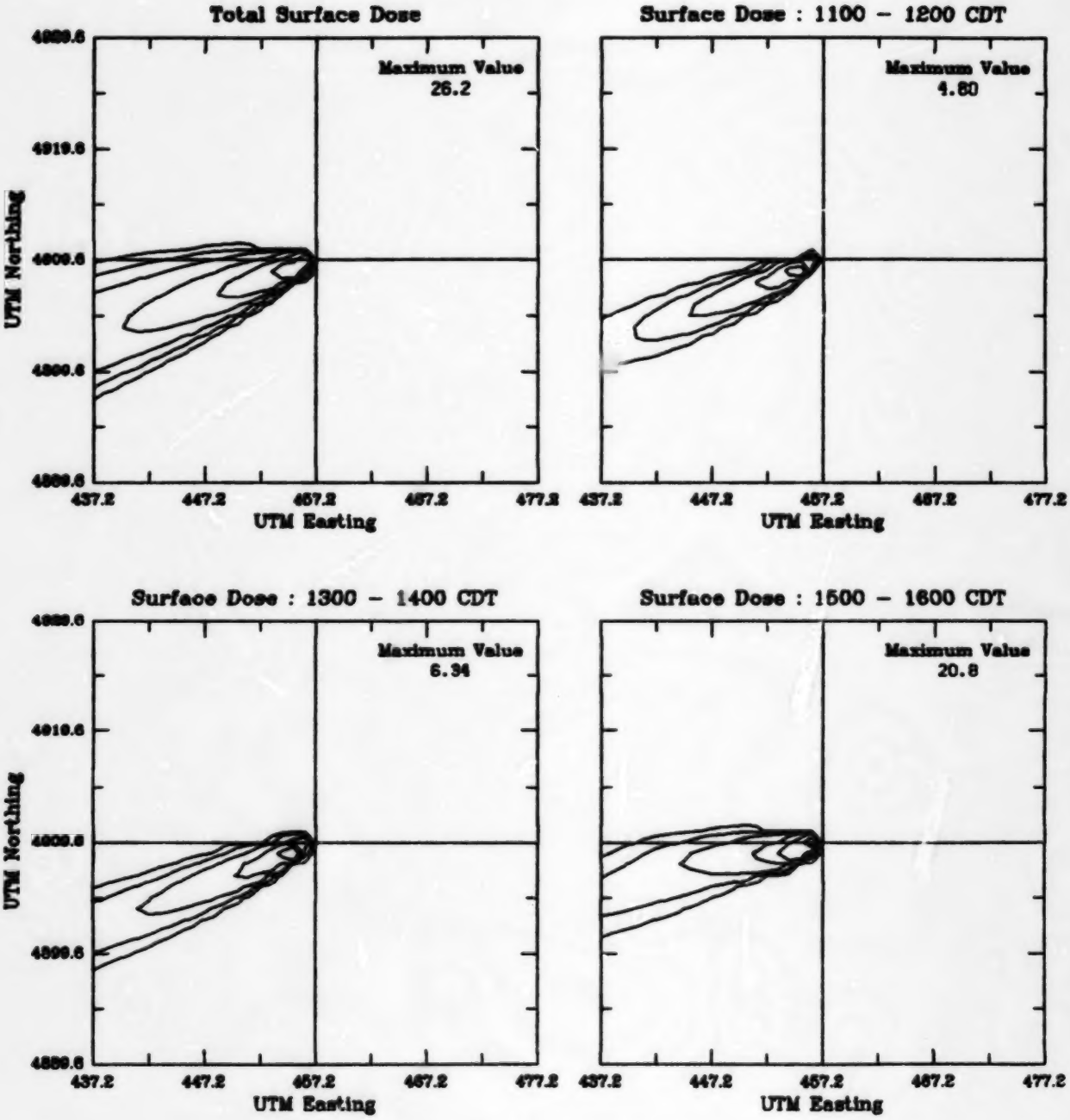


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOJ : TEST 4

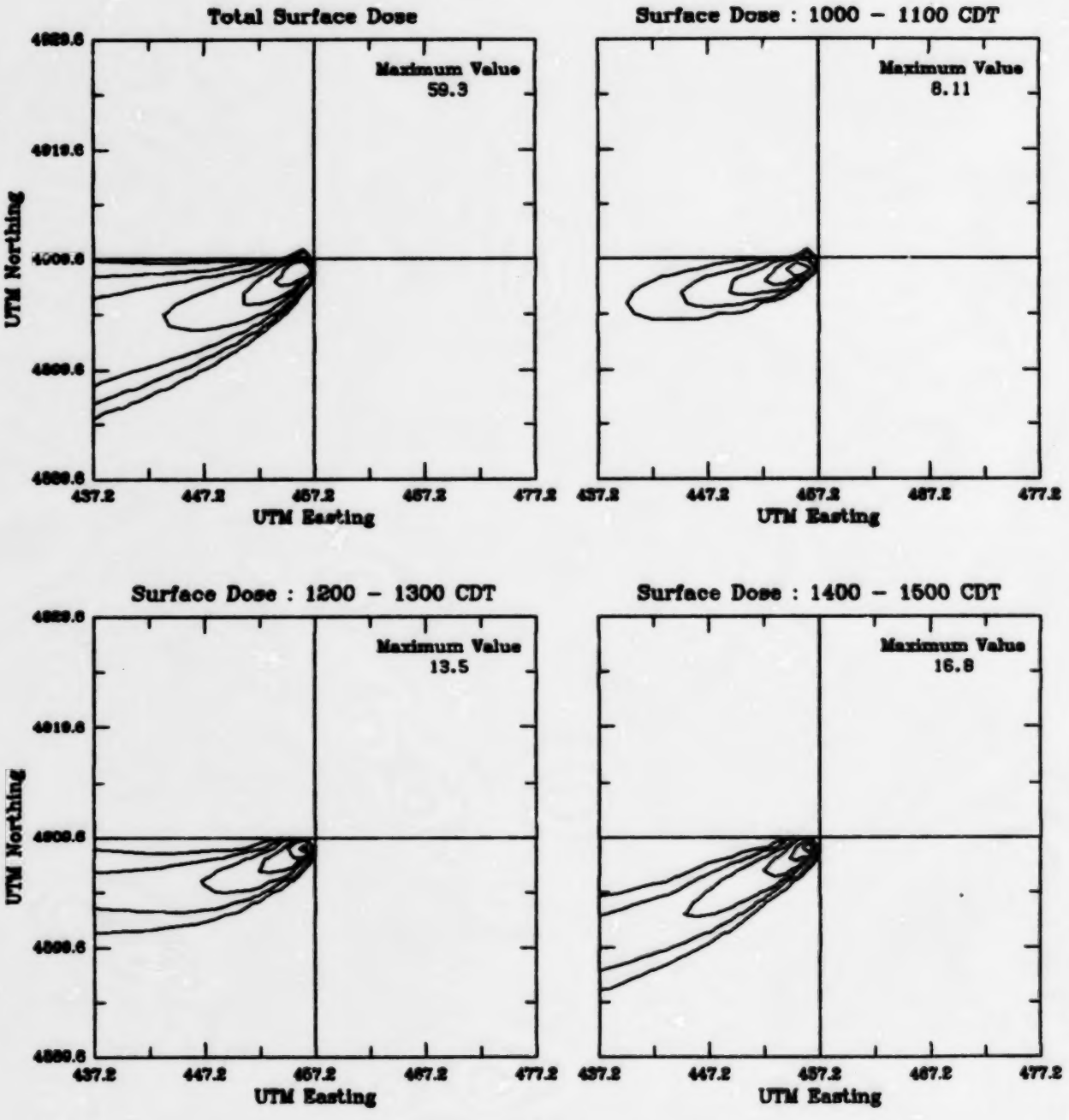


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOJ : TEST 5



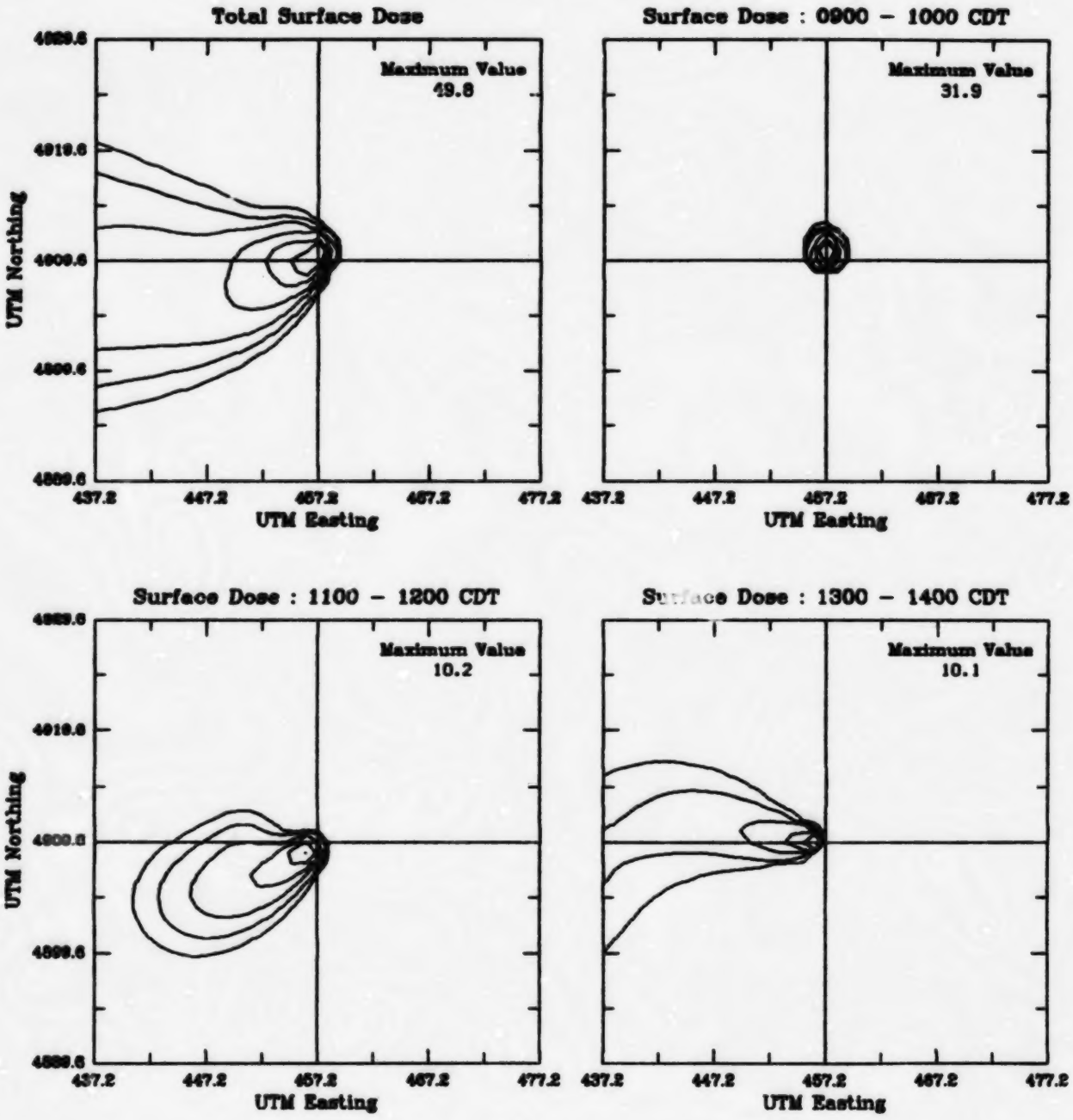
6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

111

MESOJ : TEST 6



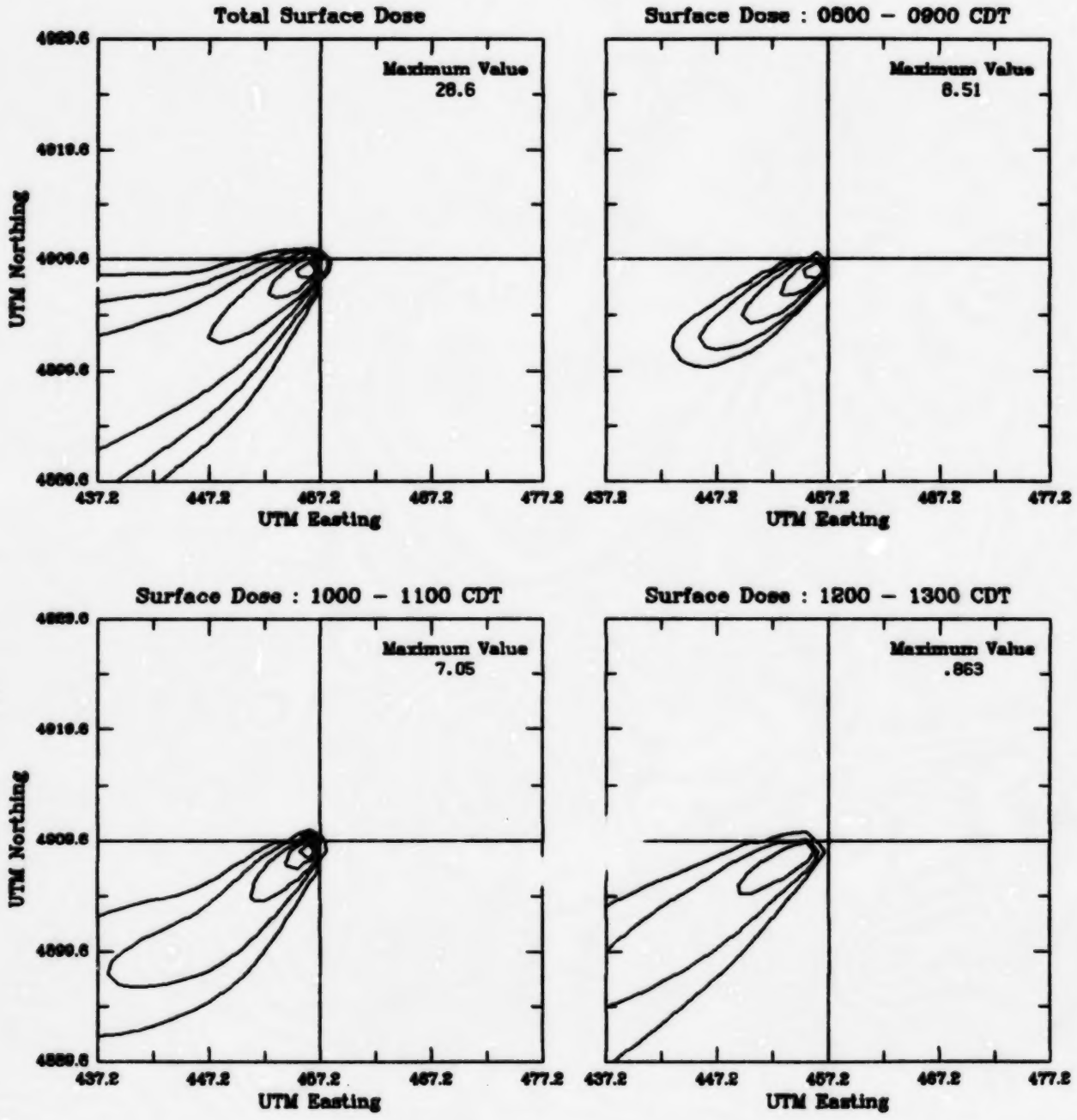
6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

1/2

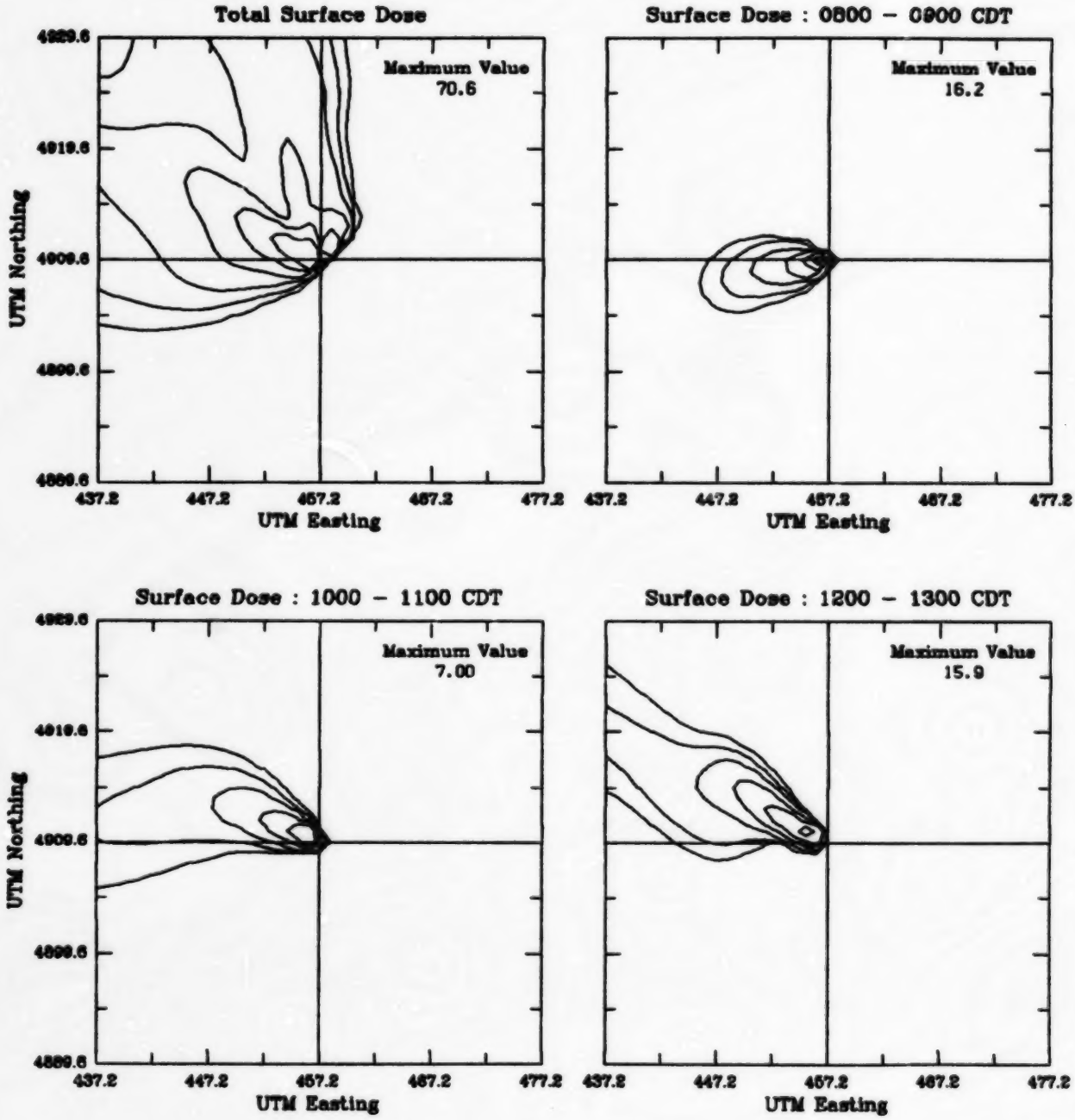
MESOJ : TEST 7



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOJ : TEST 8

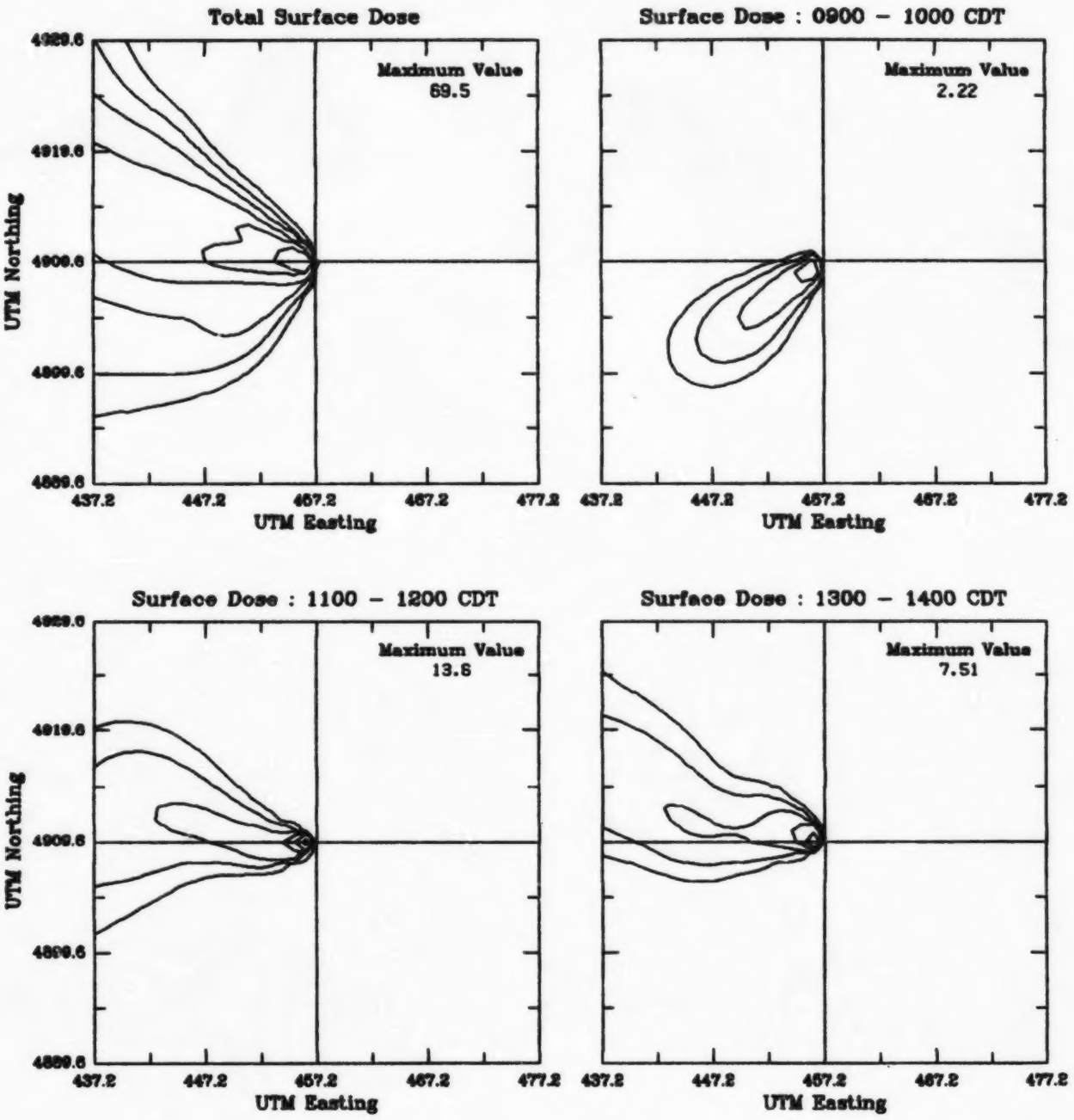


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOJ : TEST 9

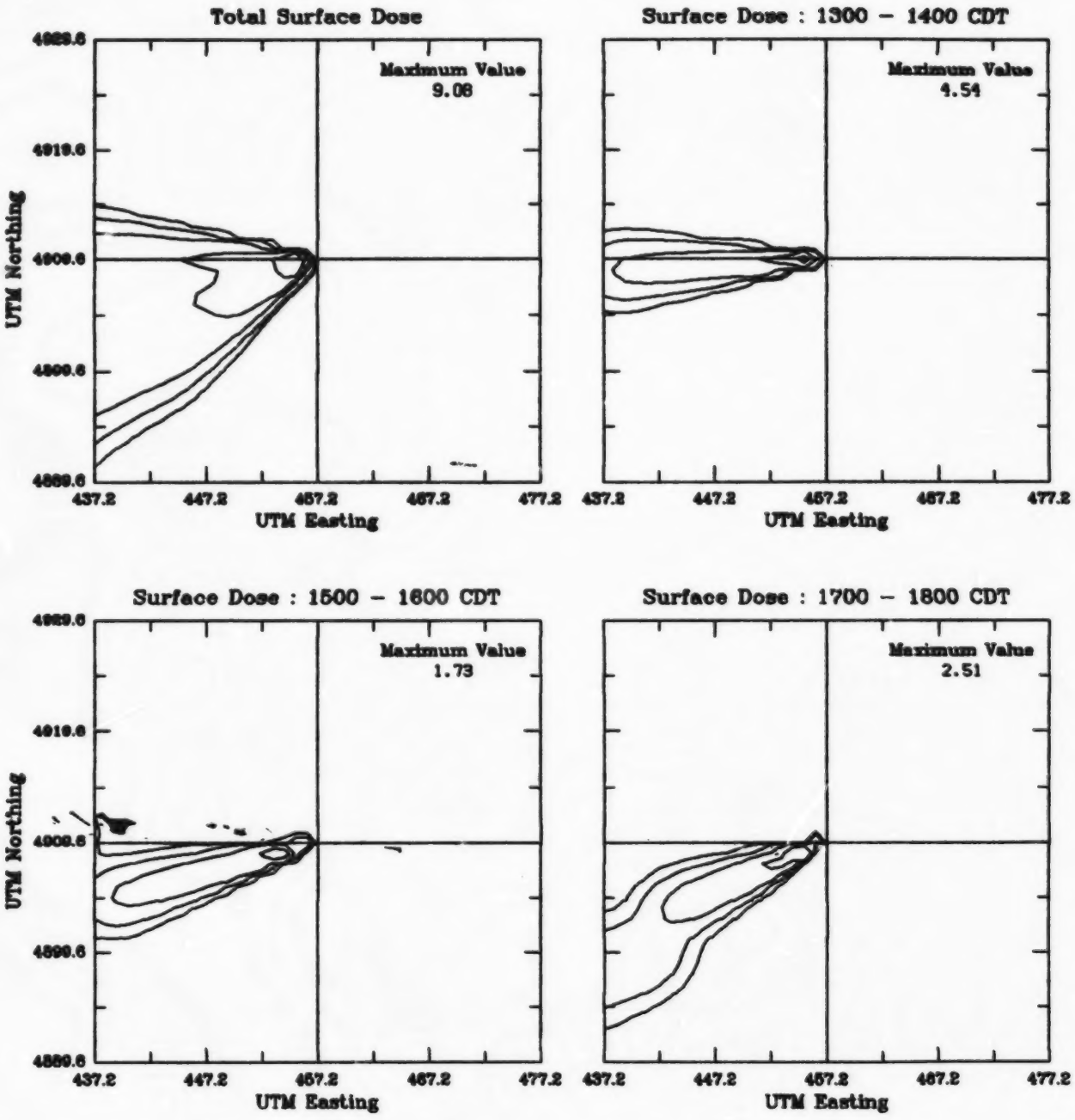


6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

115

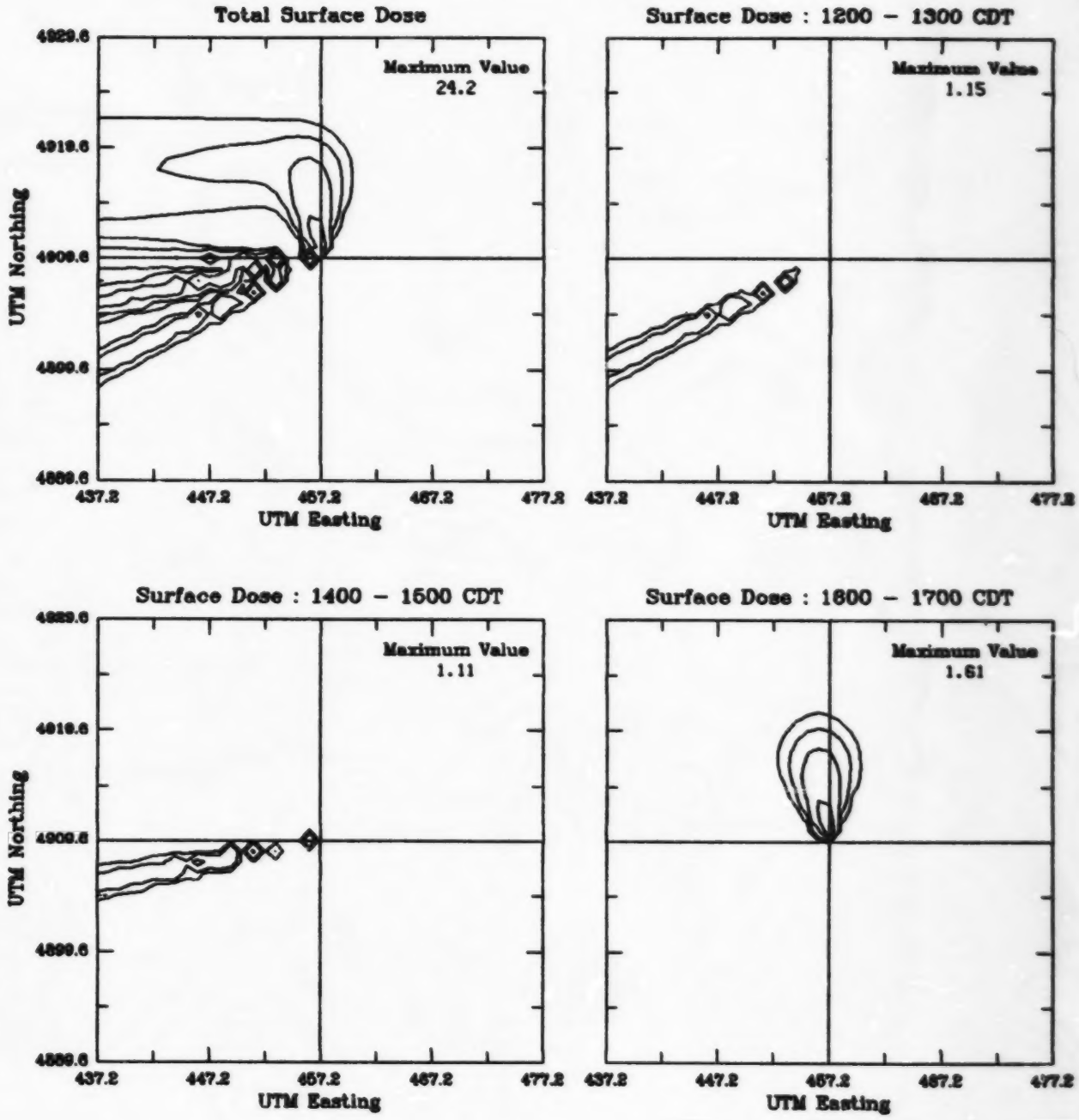
ARL : TEST 2



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ARL : TEST 3

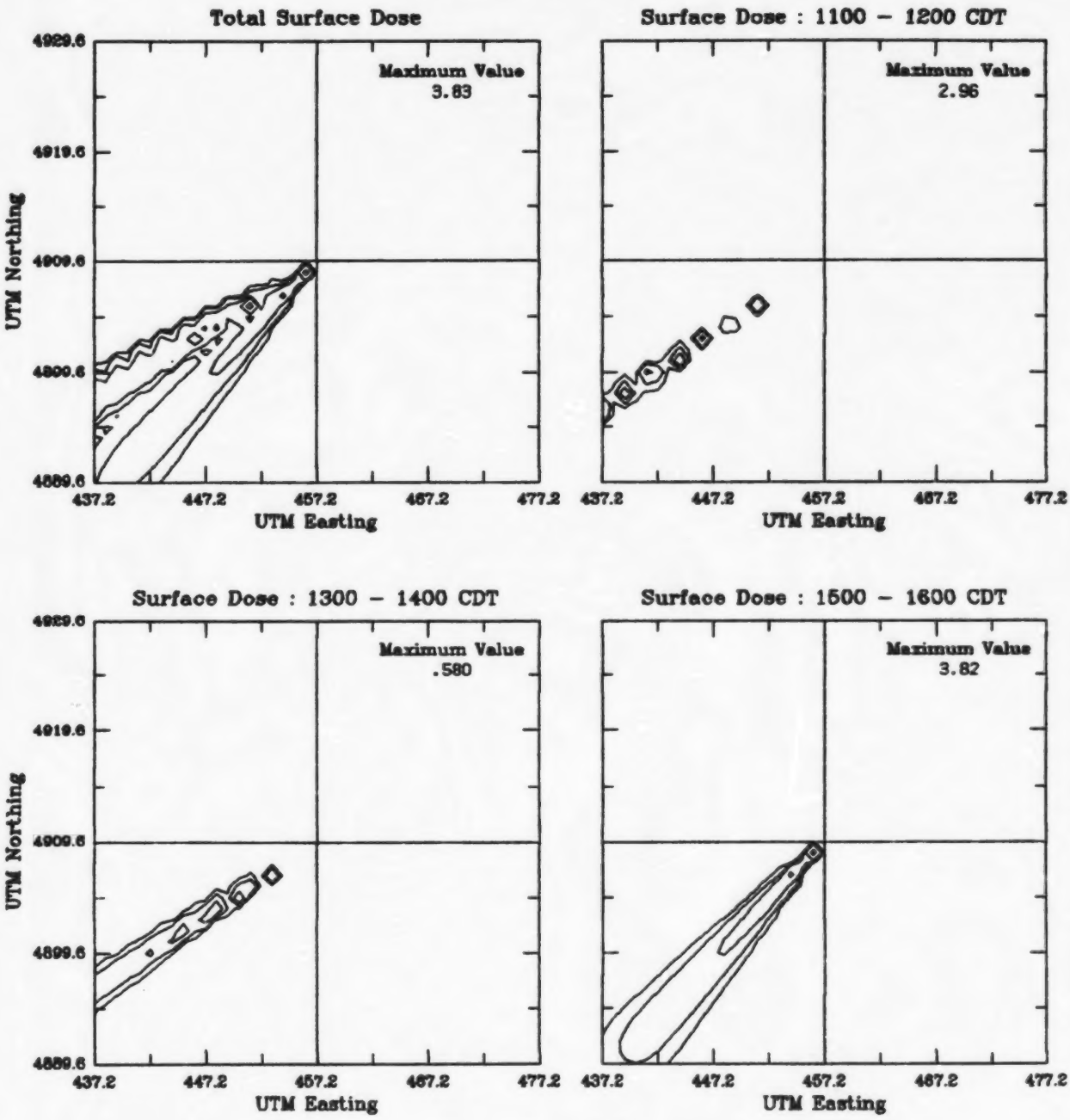


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

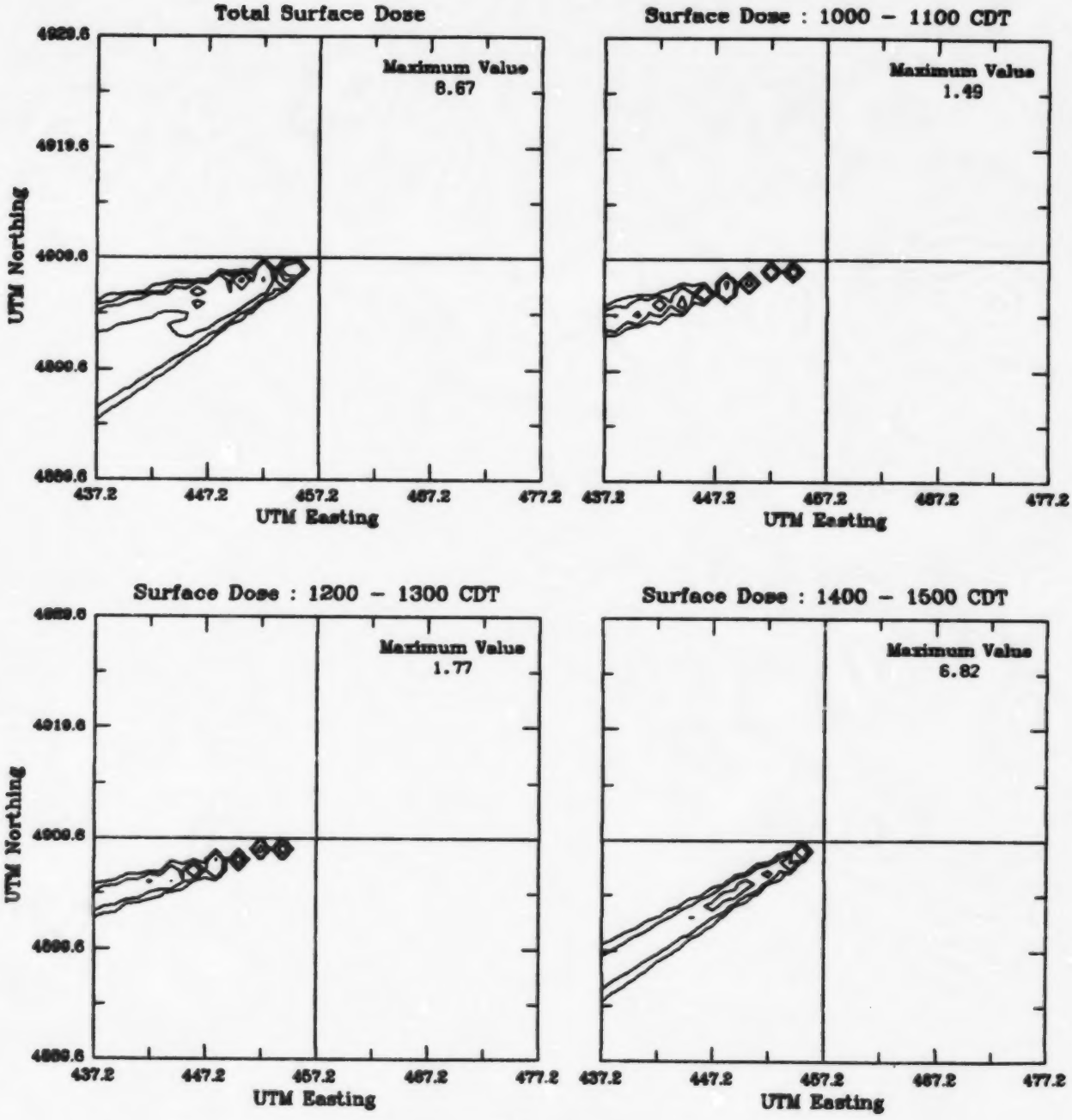
ARL : TEST 4



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ARL : TEST 5

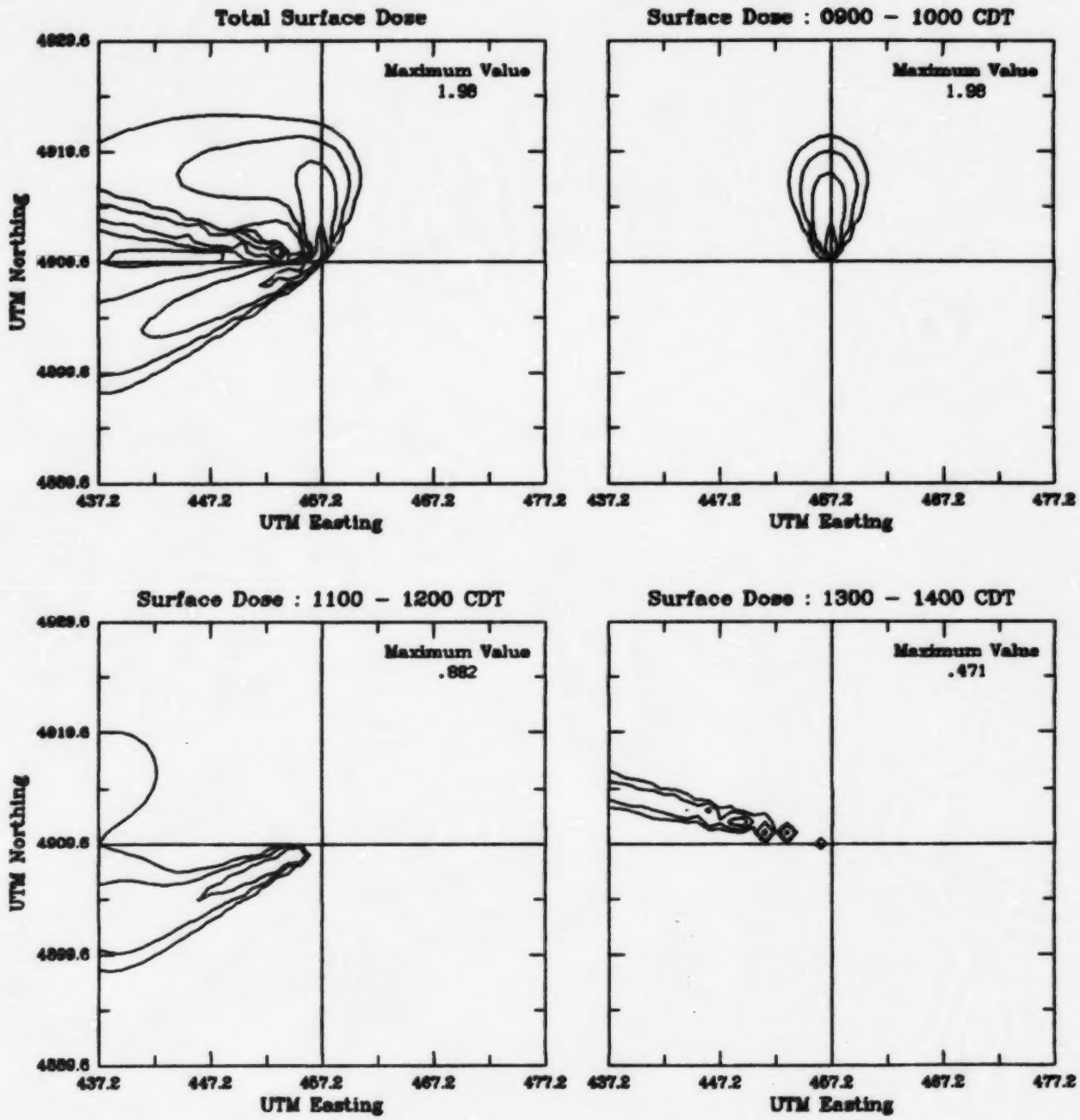


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ARL : TEST 6

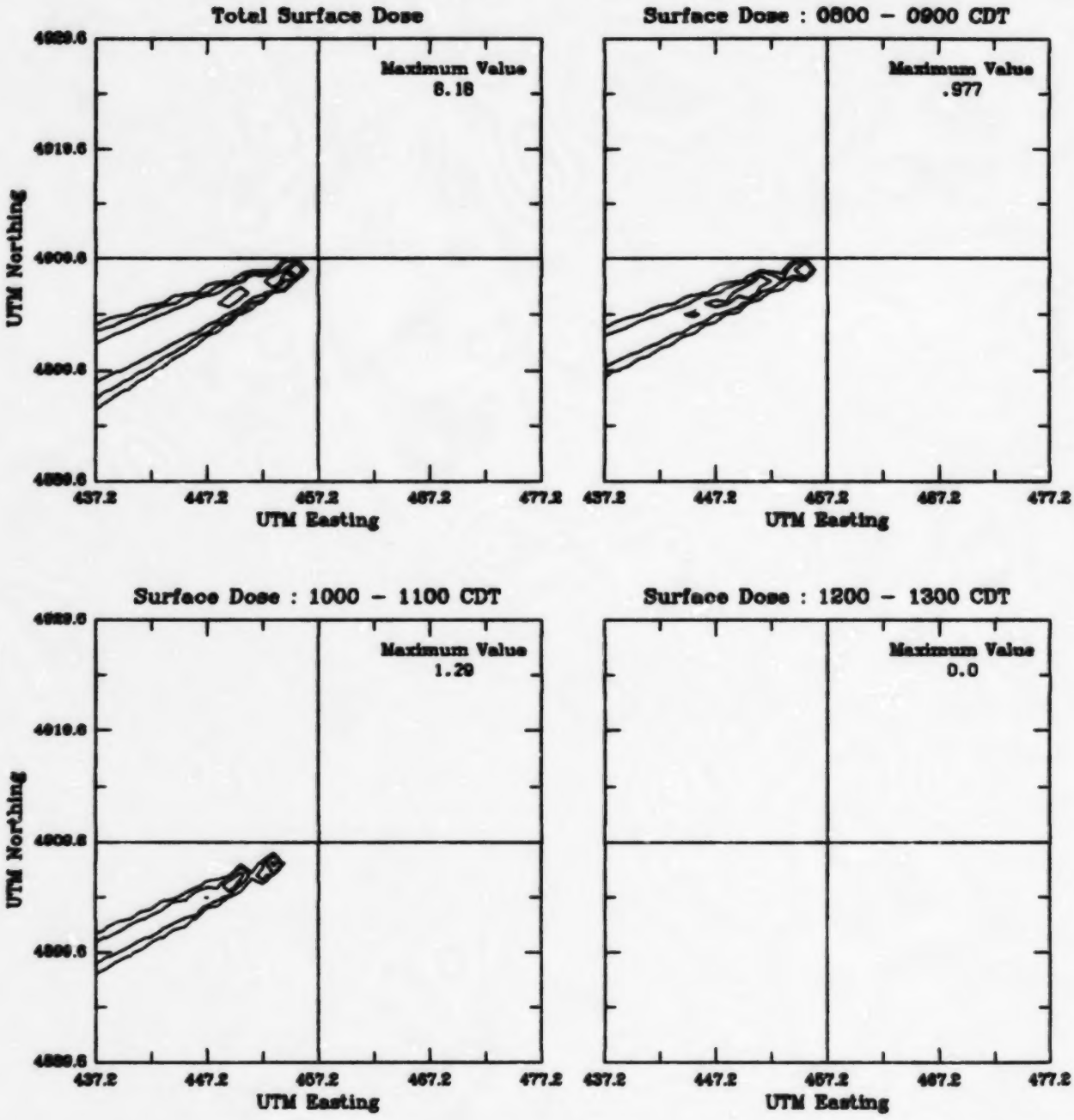


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

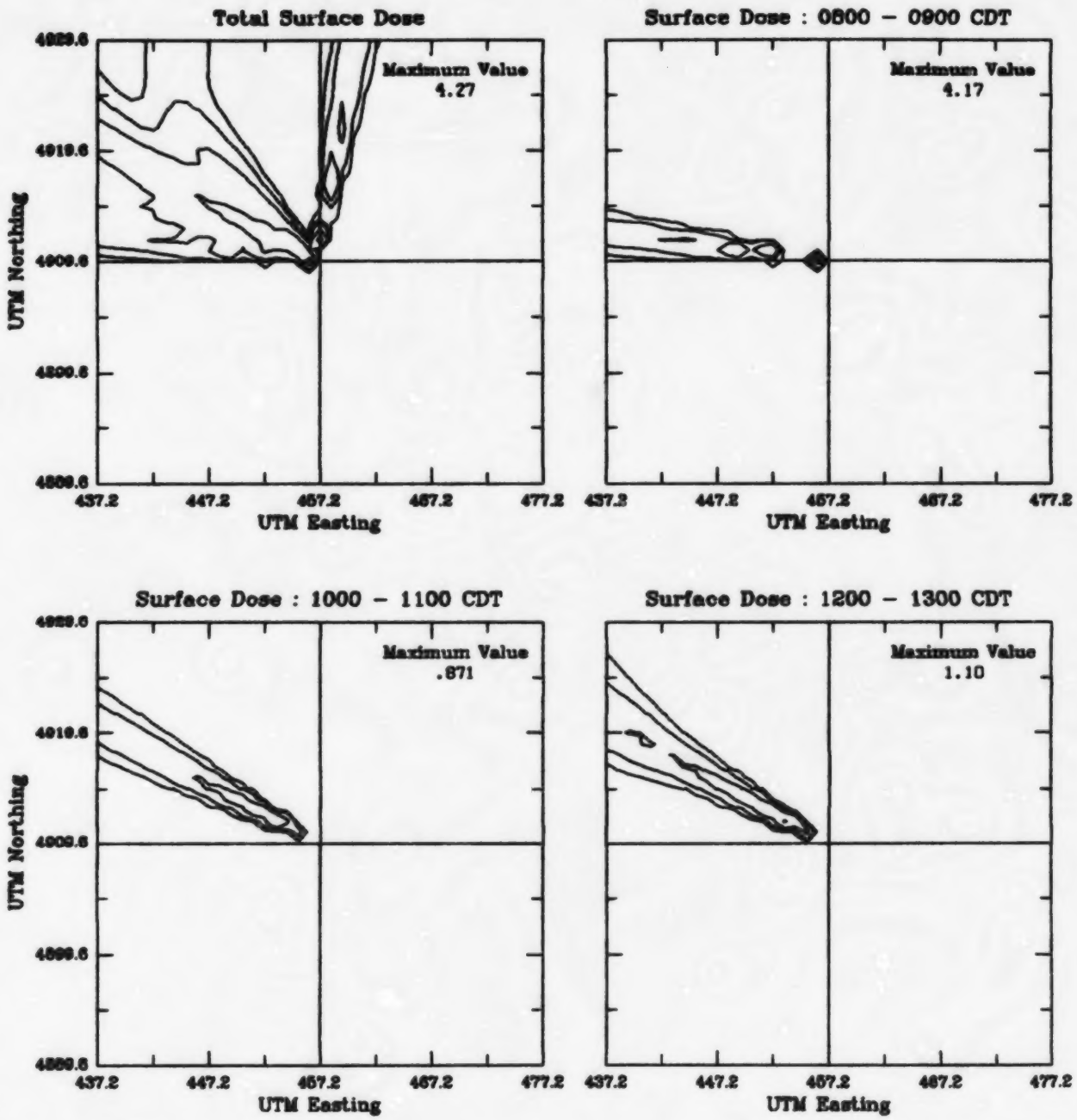
ARL : TEST 7



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

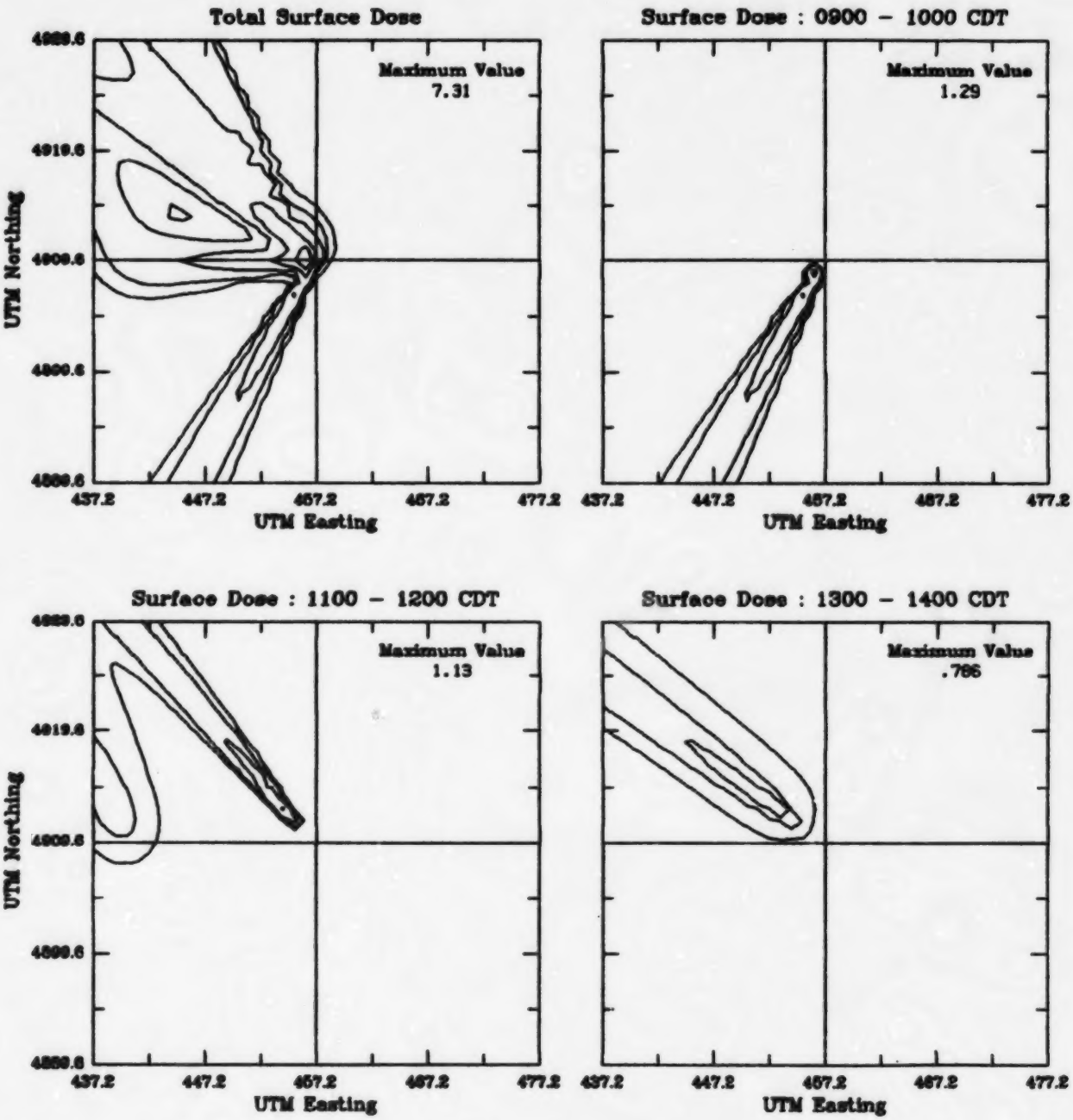
BEST COPY AVAILABLE

ARL : TEST 8



BEST COPY AVAILABLE

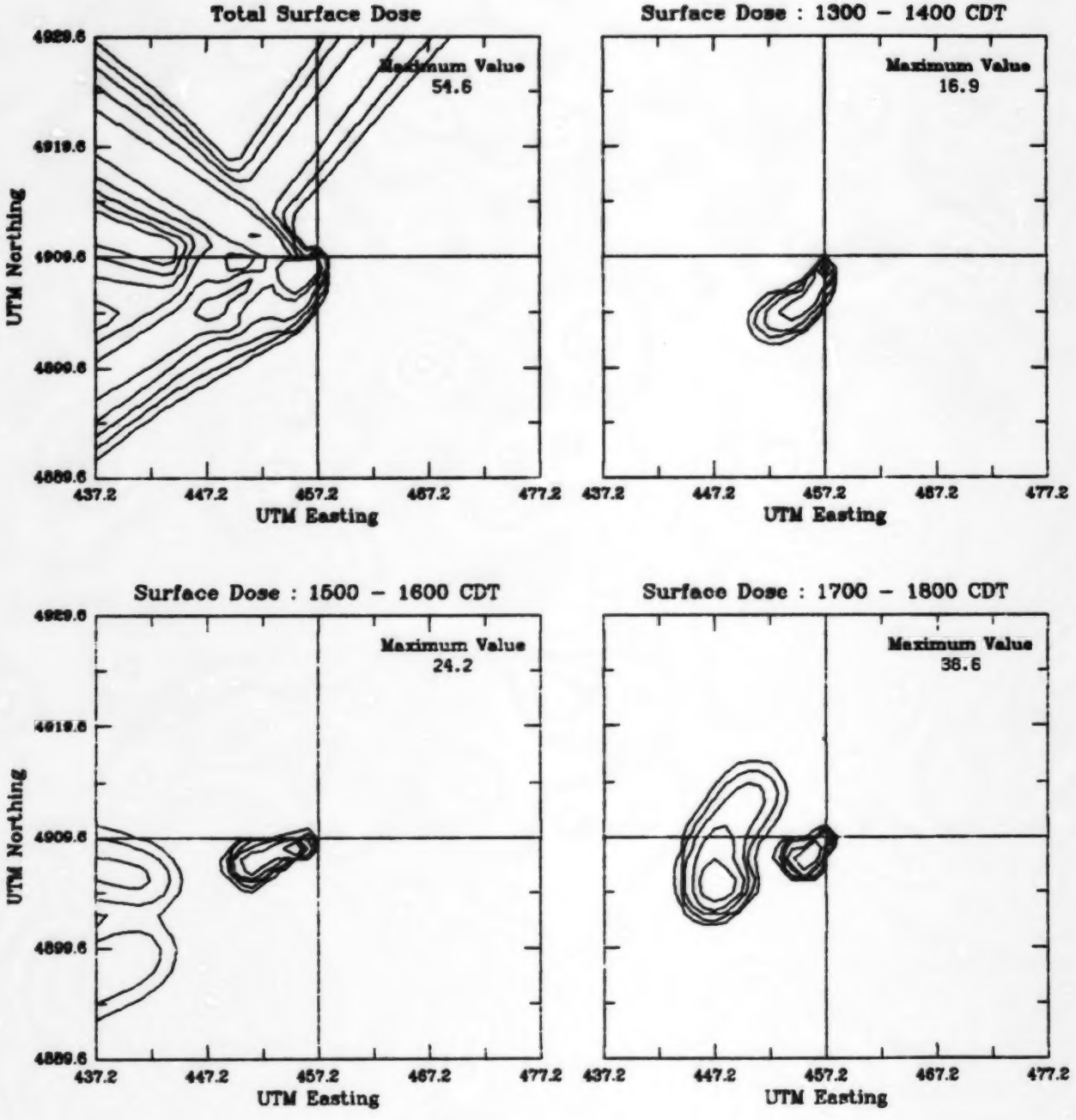
ARL : TEST 9



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

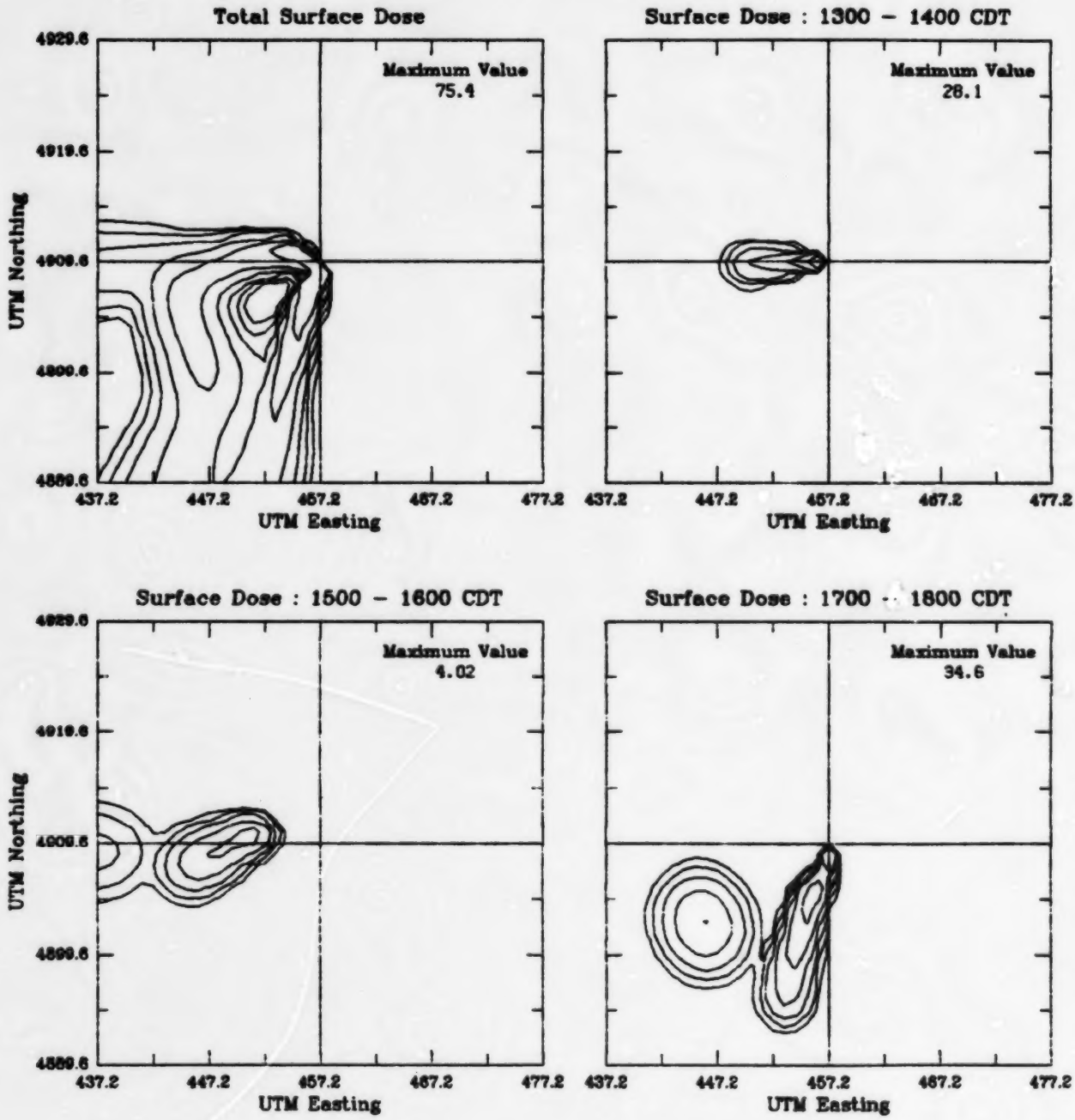
MESOT : TEST 1



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOT : TEST 2

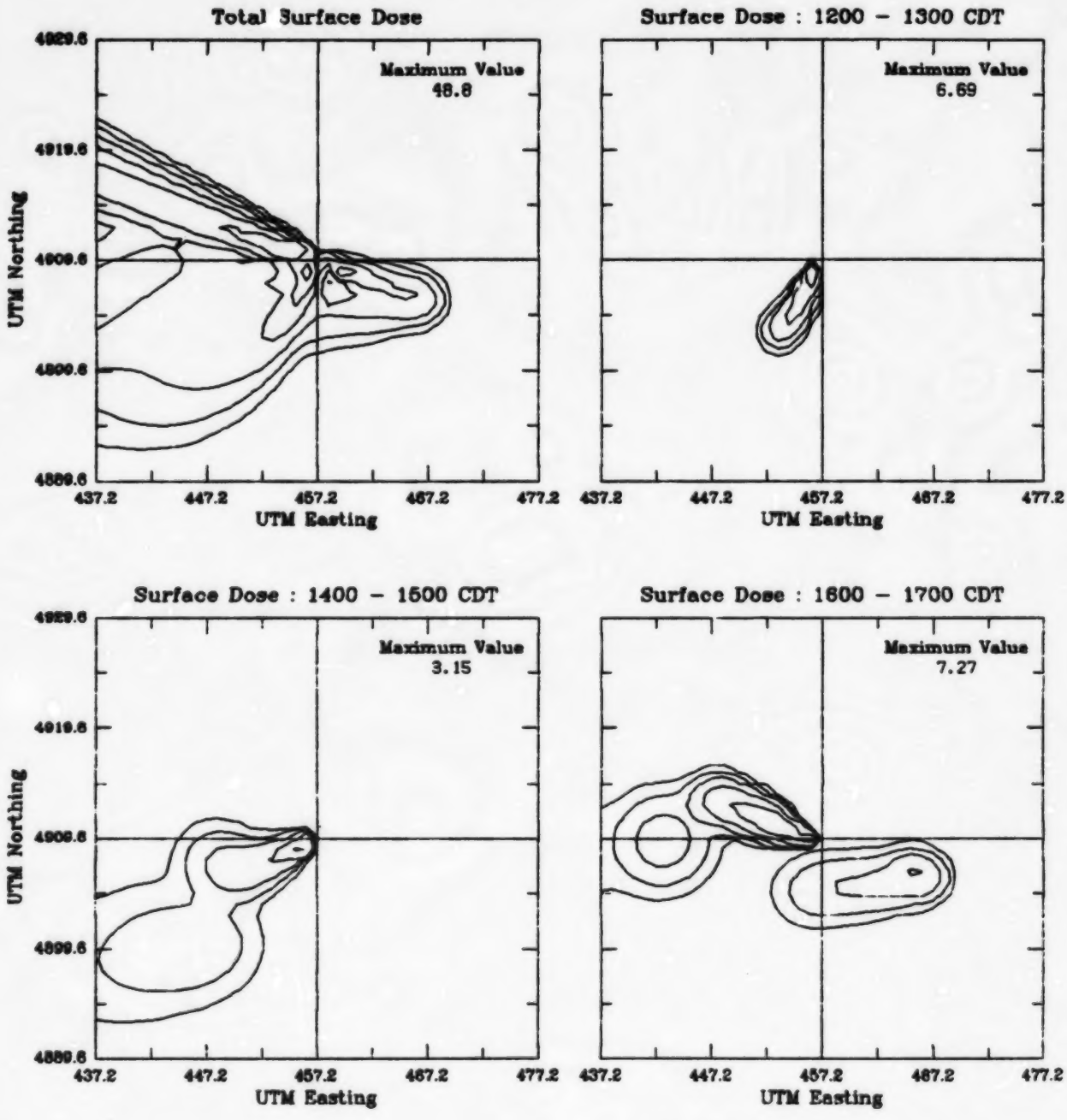


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOT : TEST 3

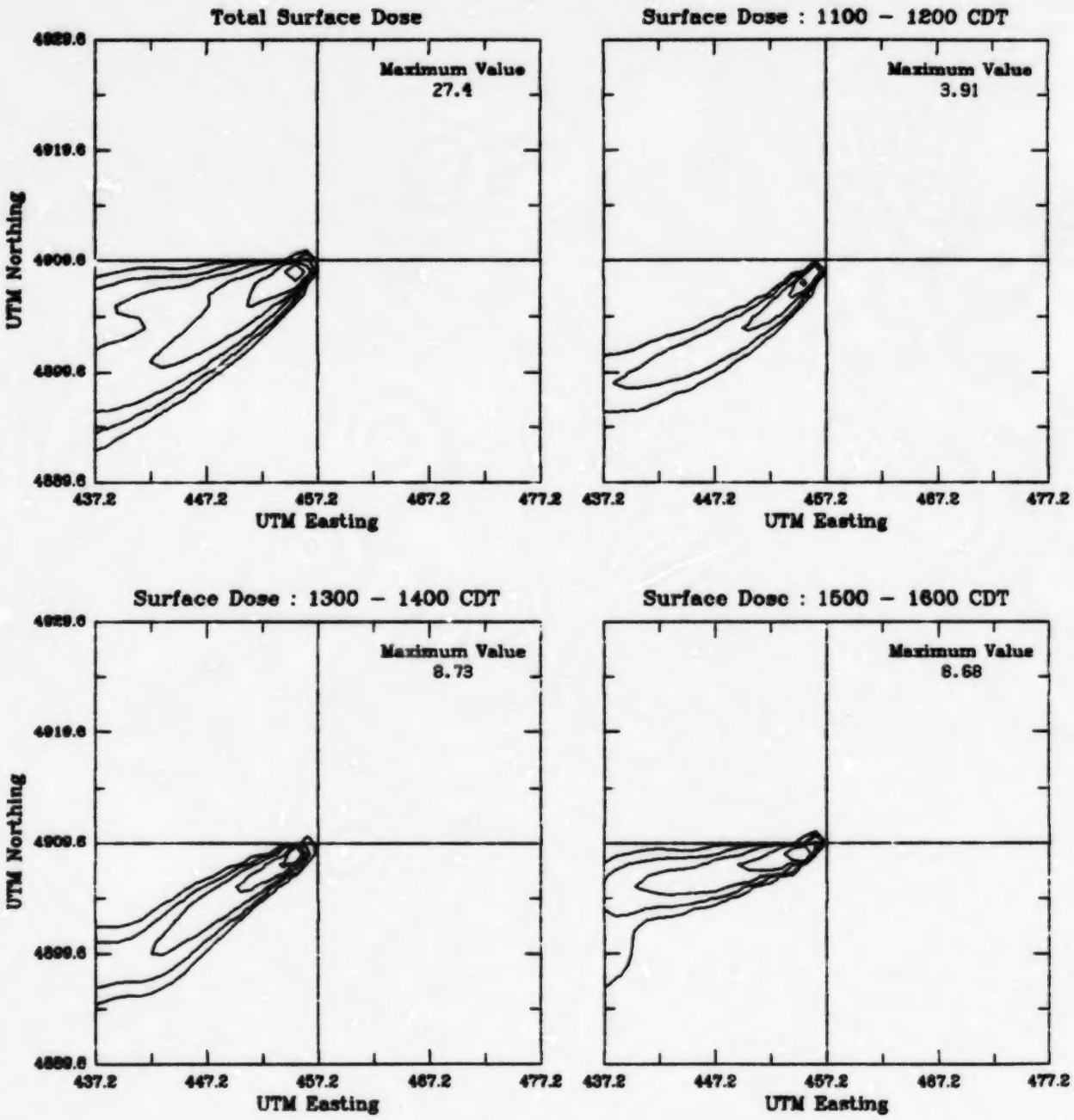


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

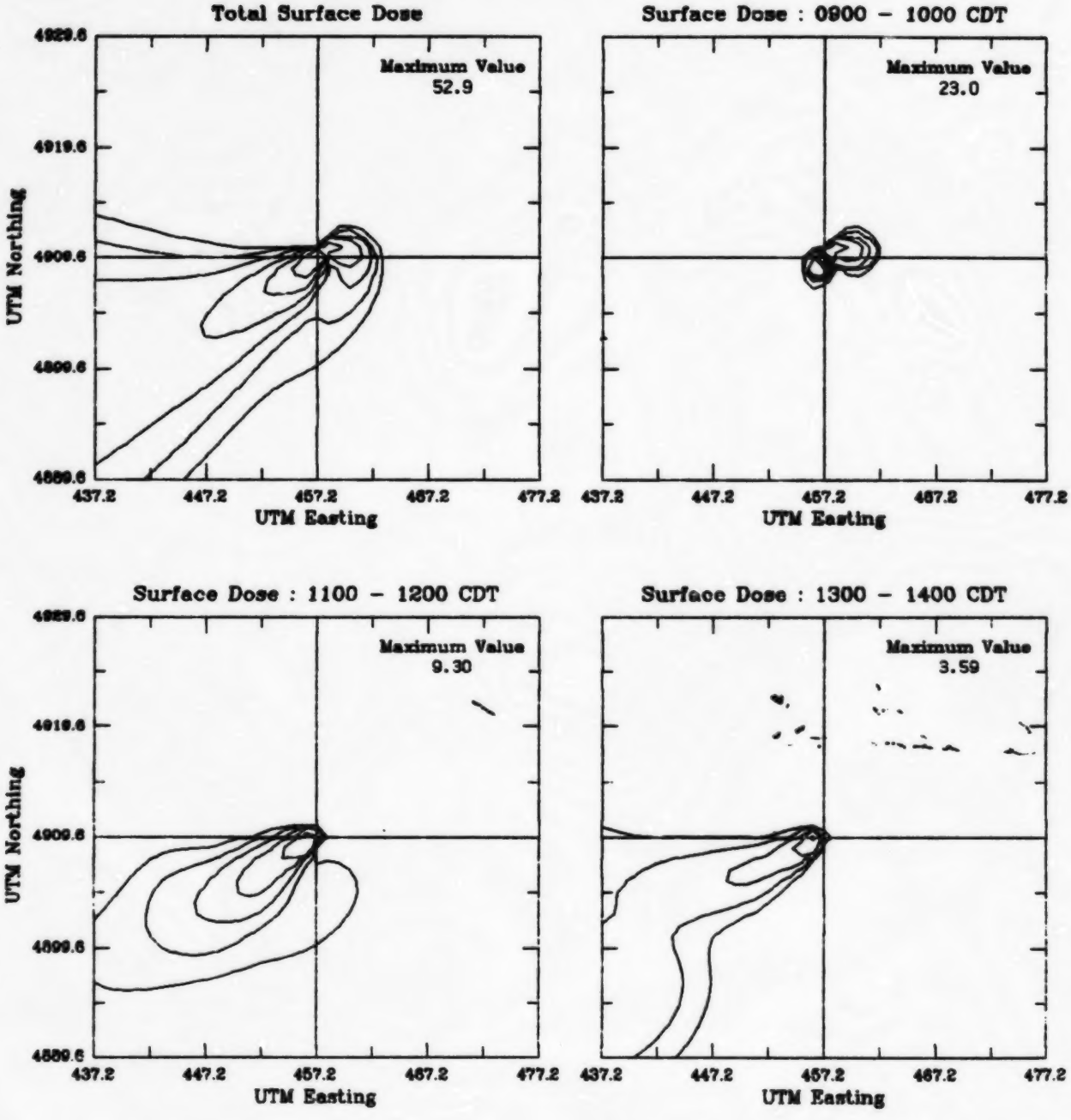
MESOT : TEST 4



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOT : TEST 6

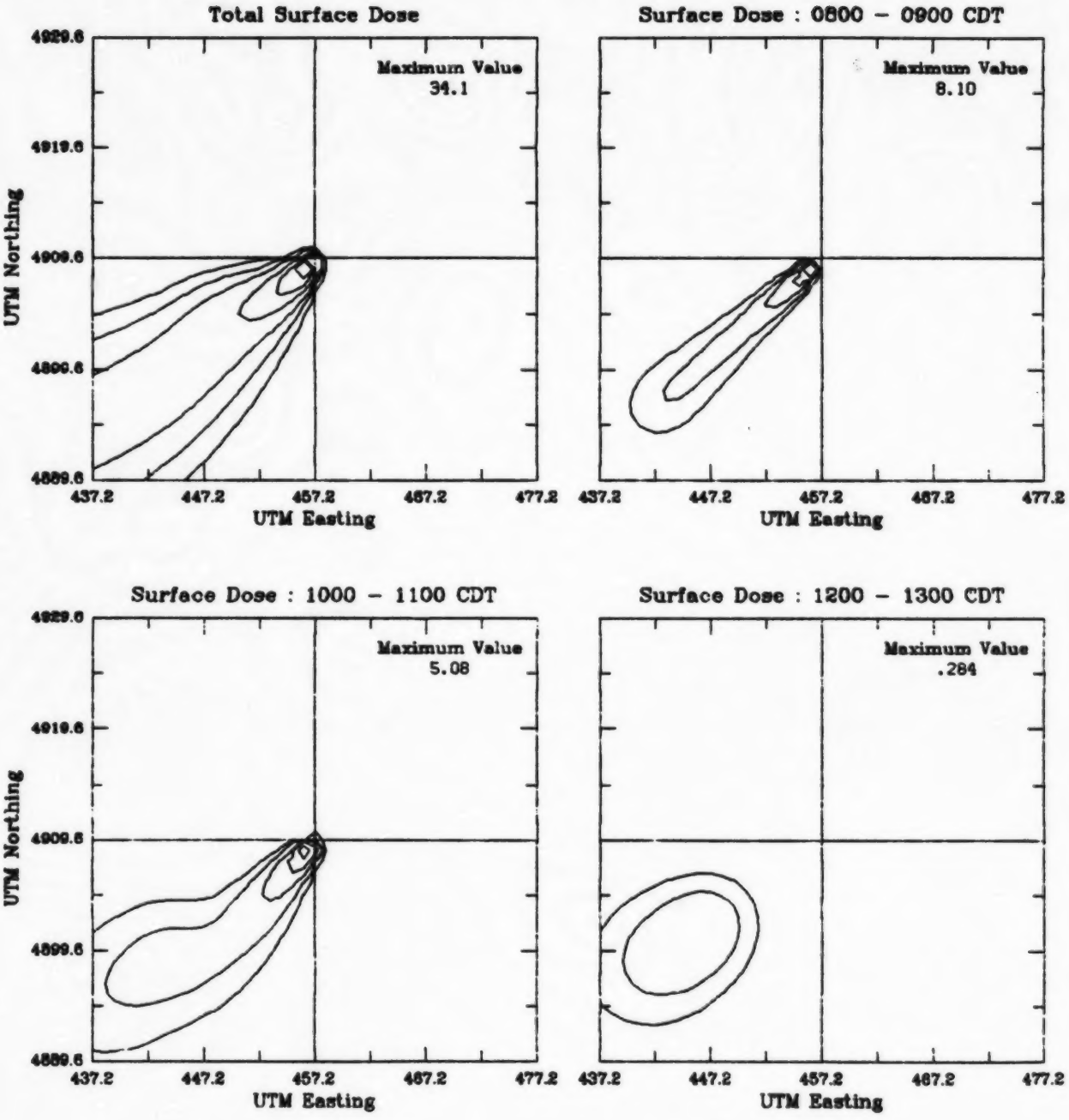


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOT : TEST 7

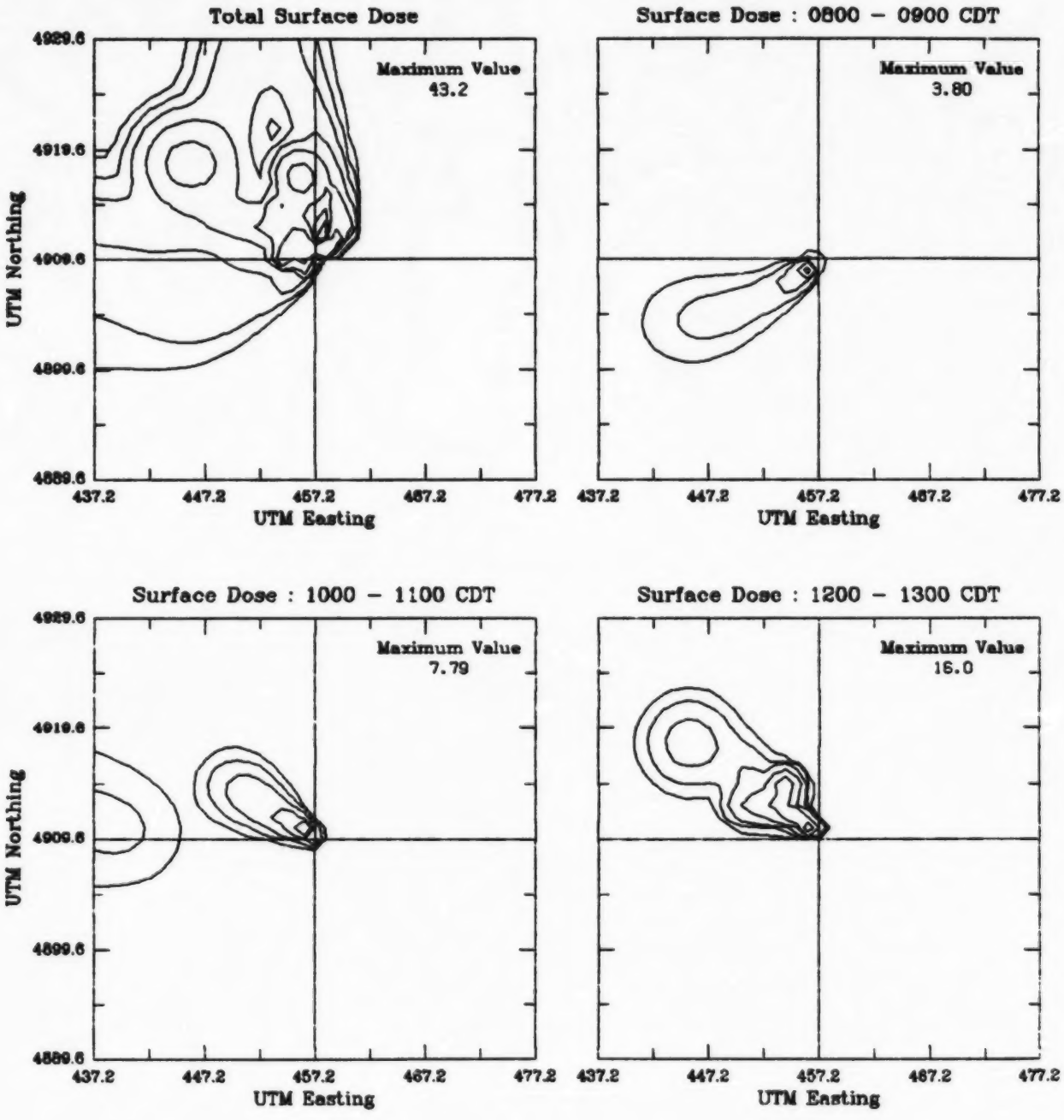


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOT : TEST 8

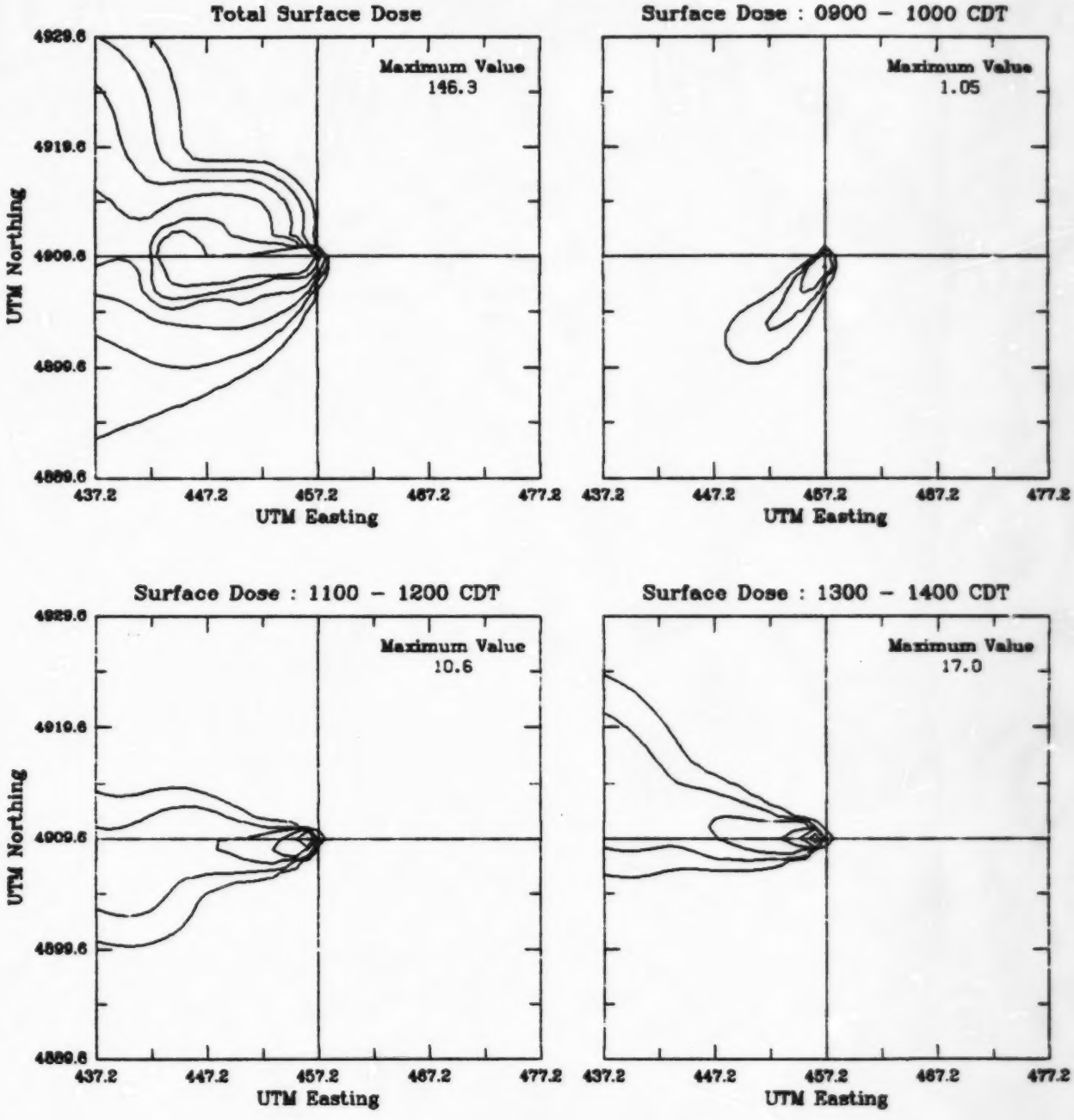


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

MESOT : TEST 9

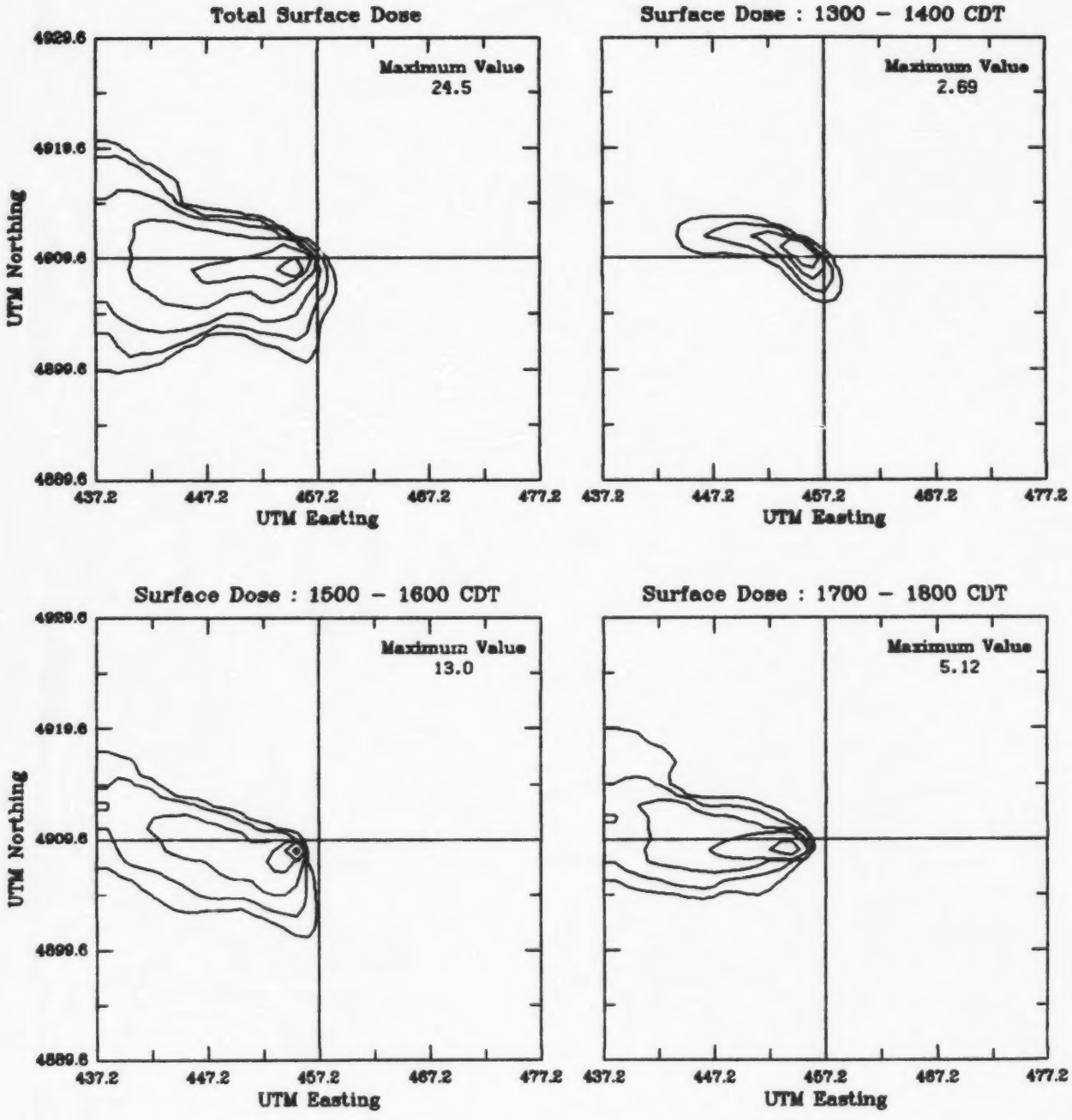


6 Contours : (PPM–Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

PATRIC : TEST 2

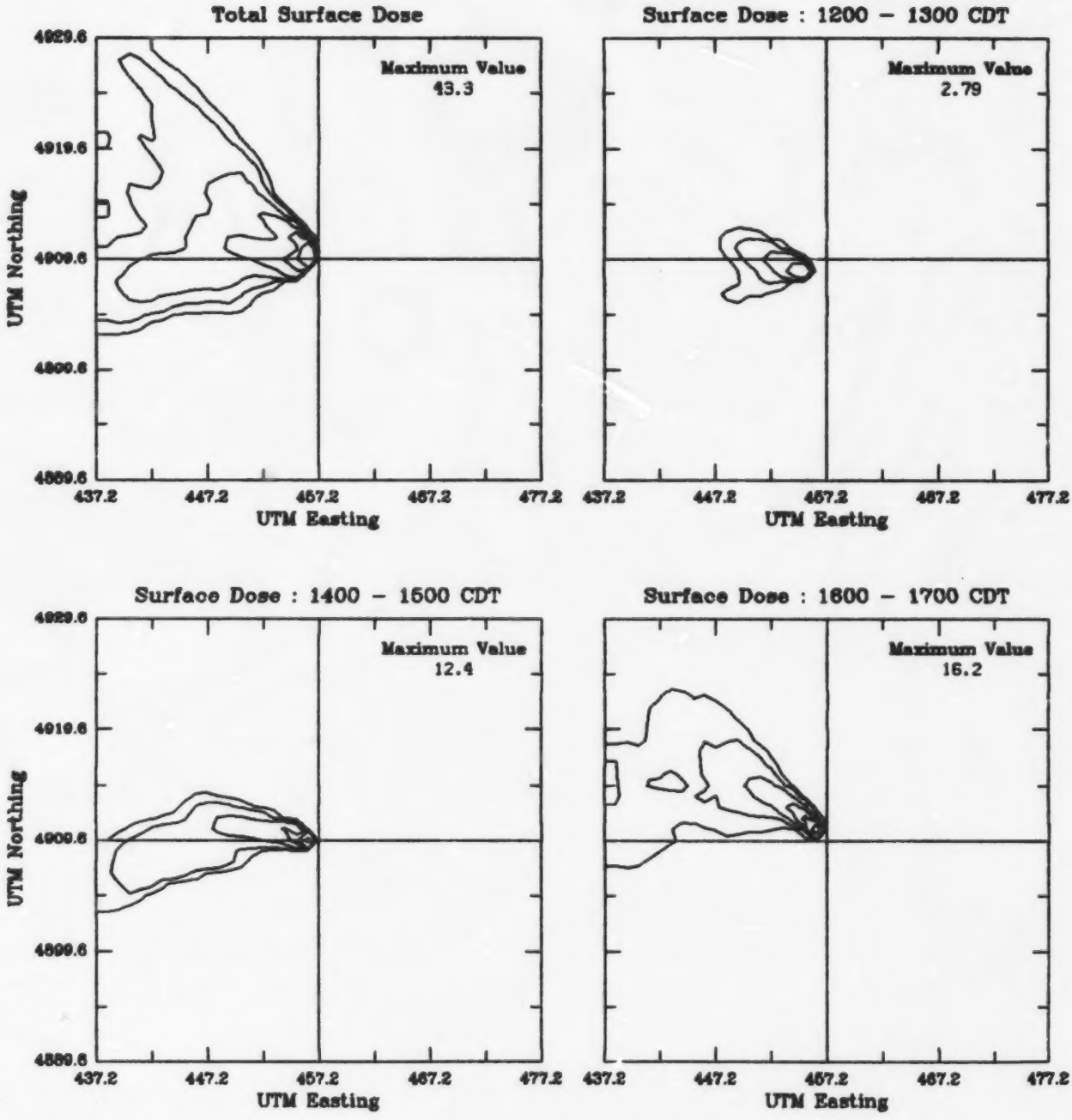


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

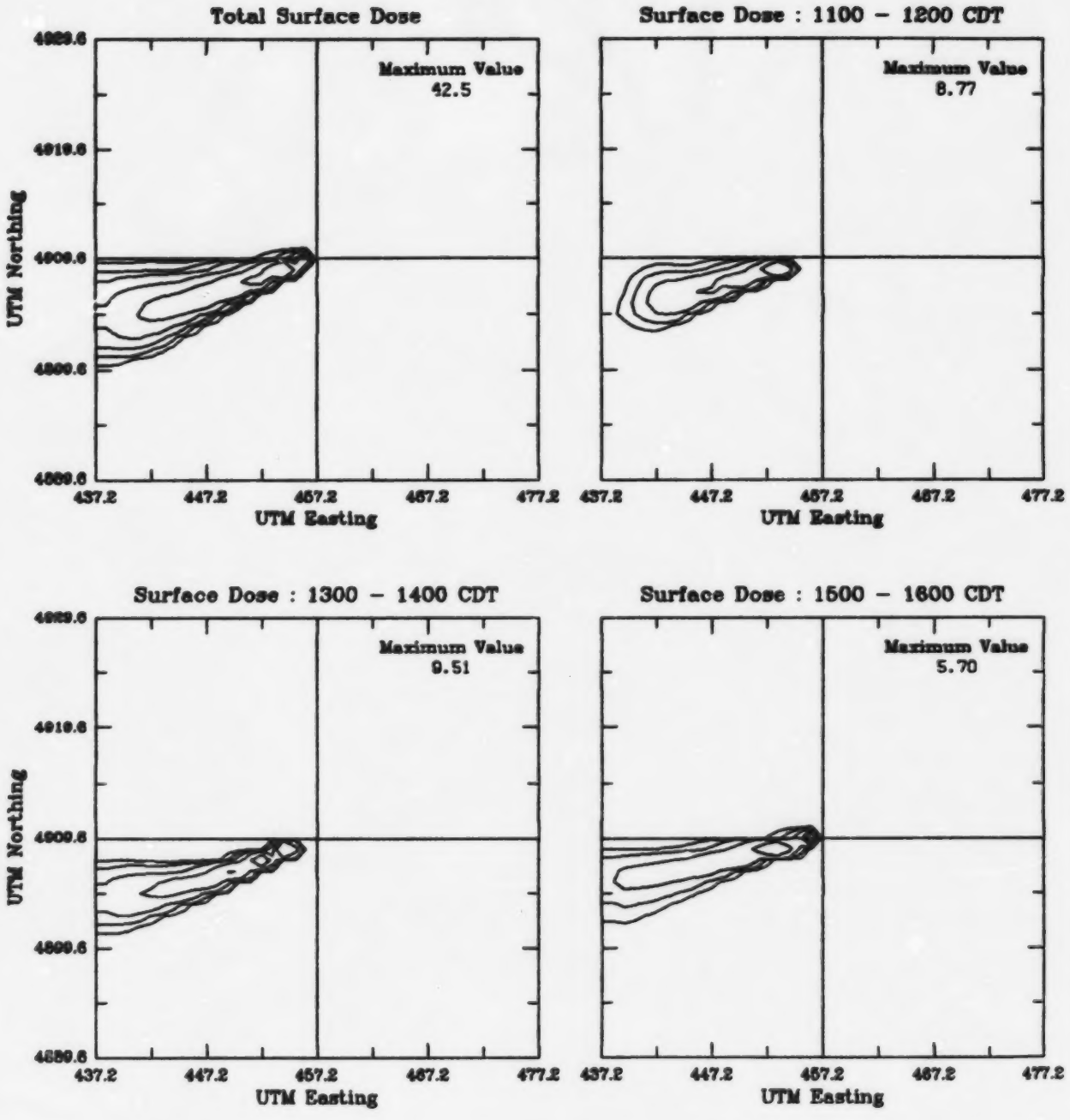
PATRIC : TEST 3



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

PATRIC : TEST 4

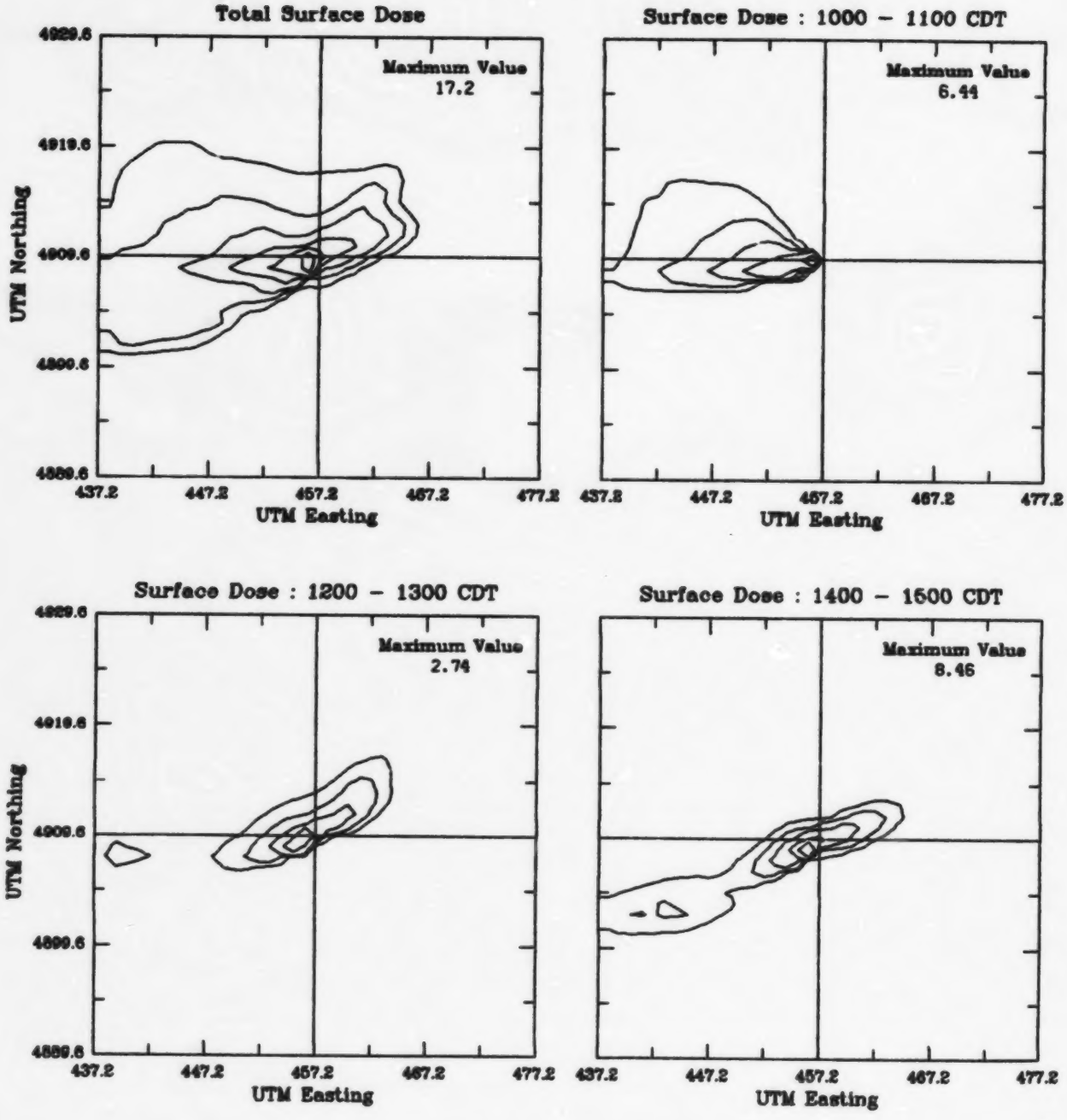


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

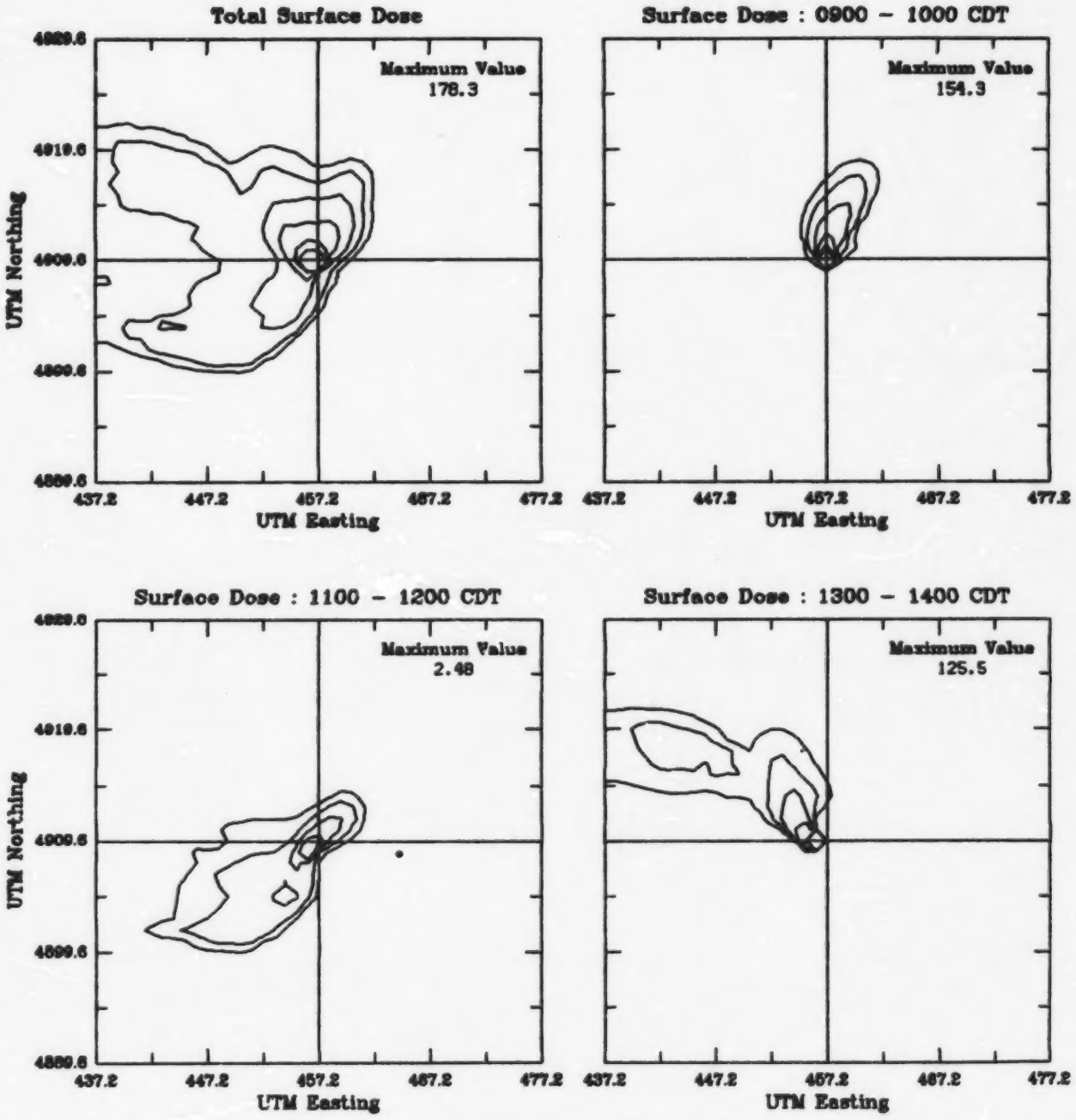
PATRIC : TEST 5



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

PATRIC : TEST 6

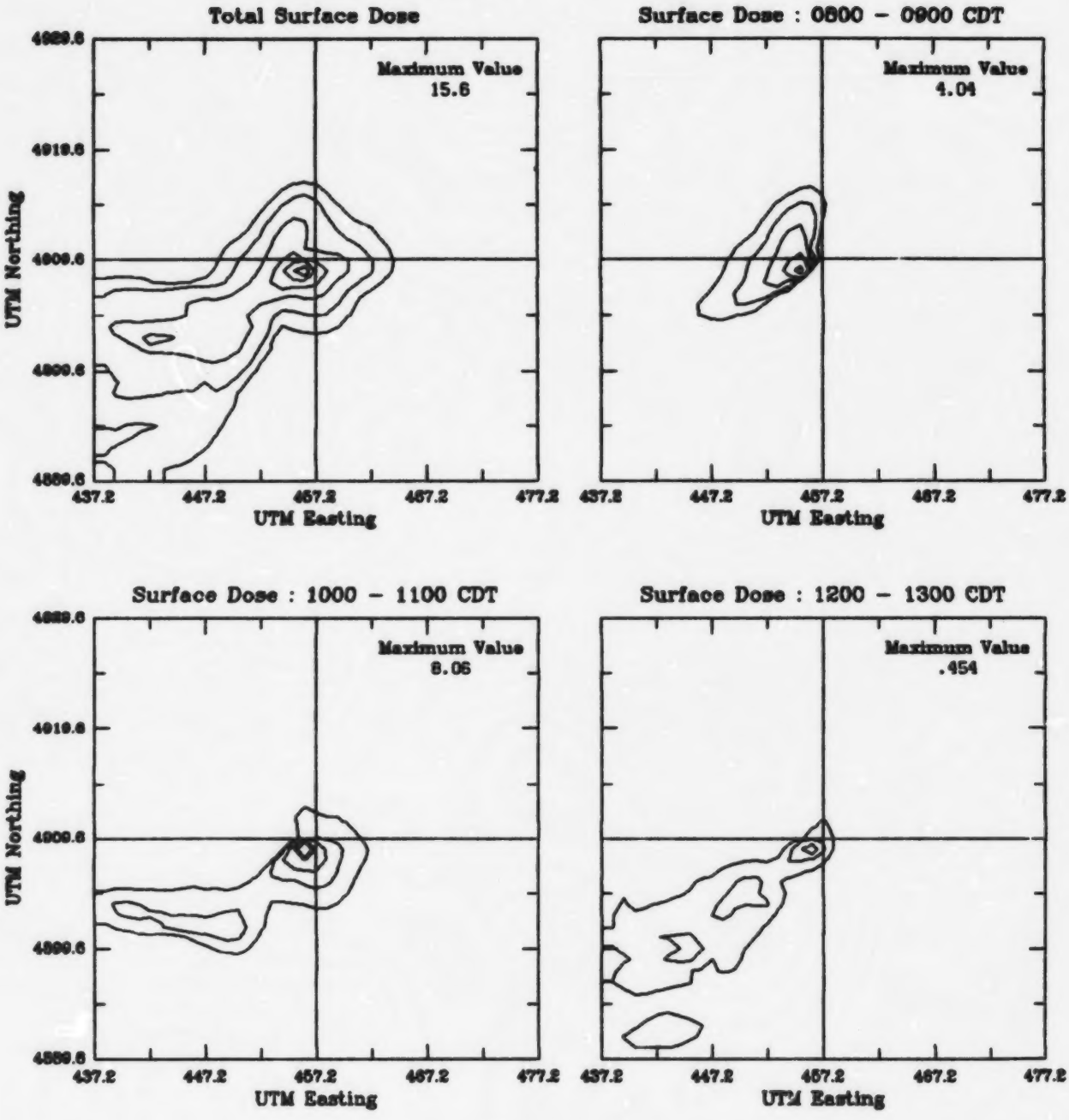


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

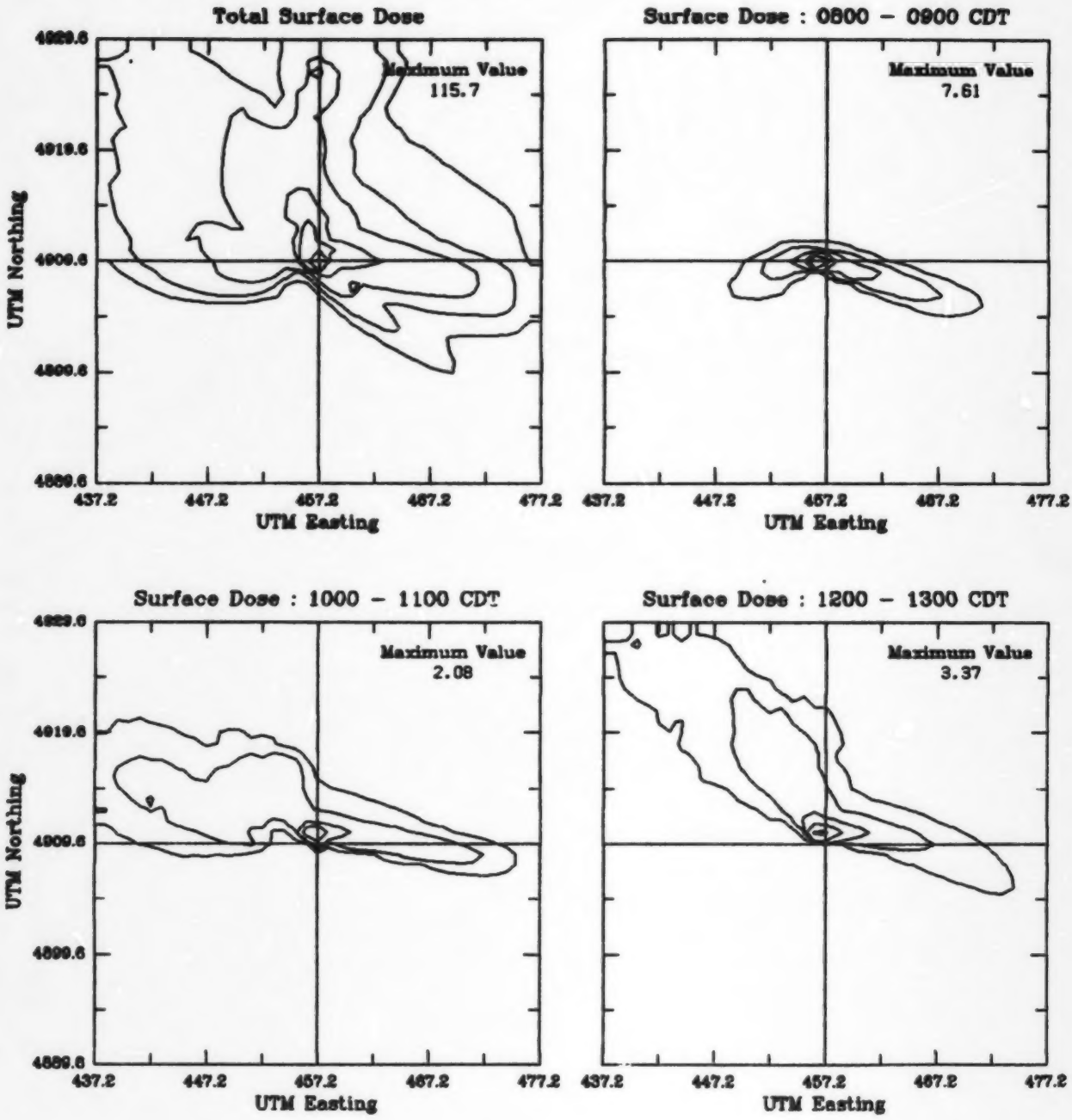
BEST COPY AVAILABLE

PATRIC : TEST 7



BEST COPY AVAILABLE

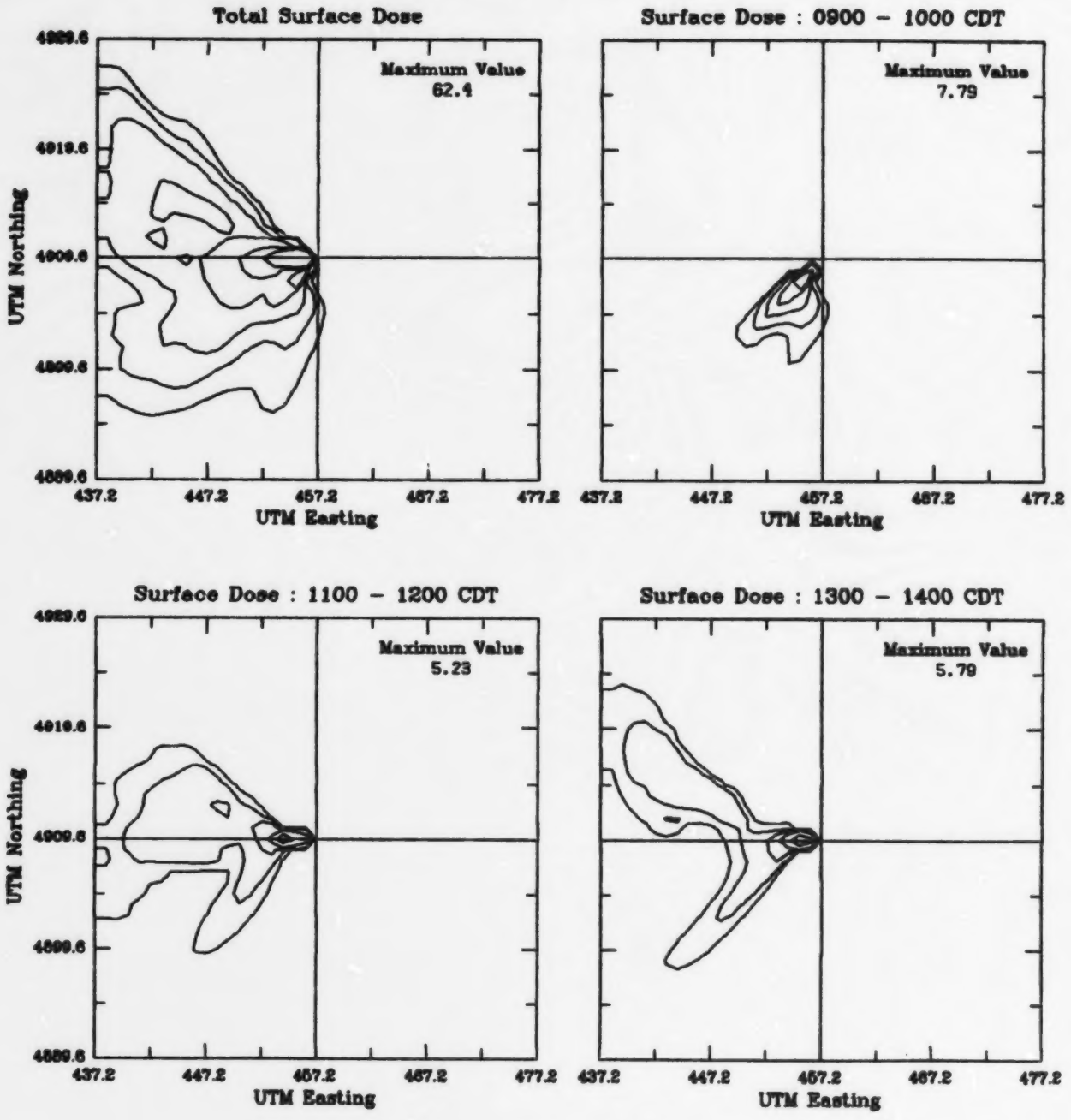
PATRIC : TEST 8



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

PATRIC : TEST 9

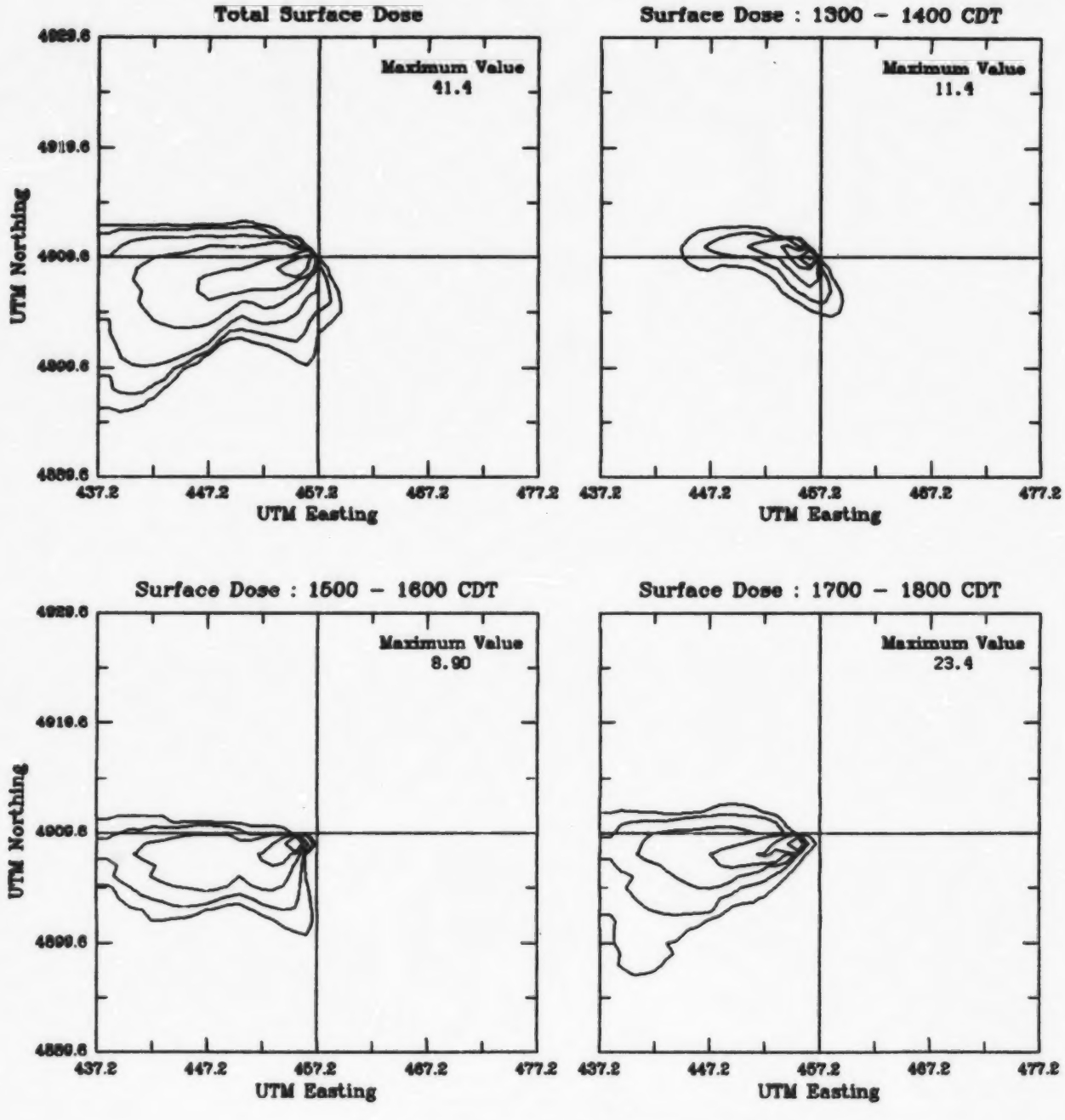


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ADPIC : TEST 2

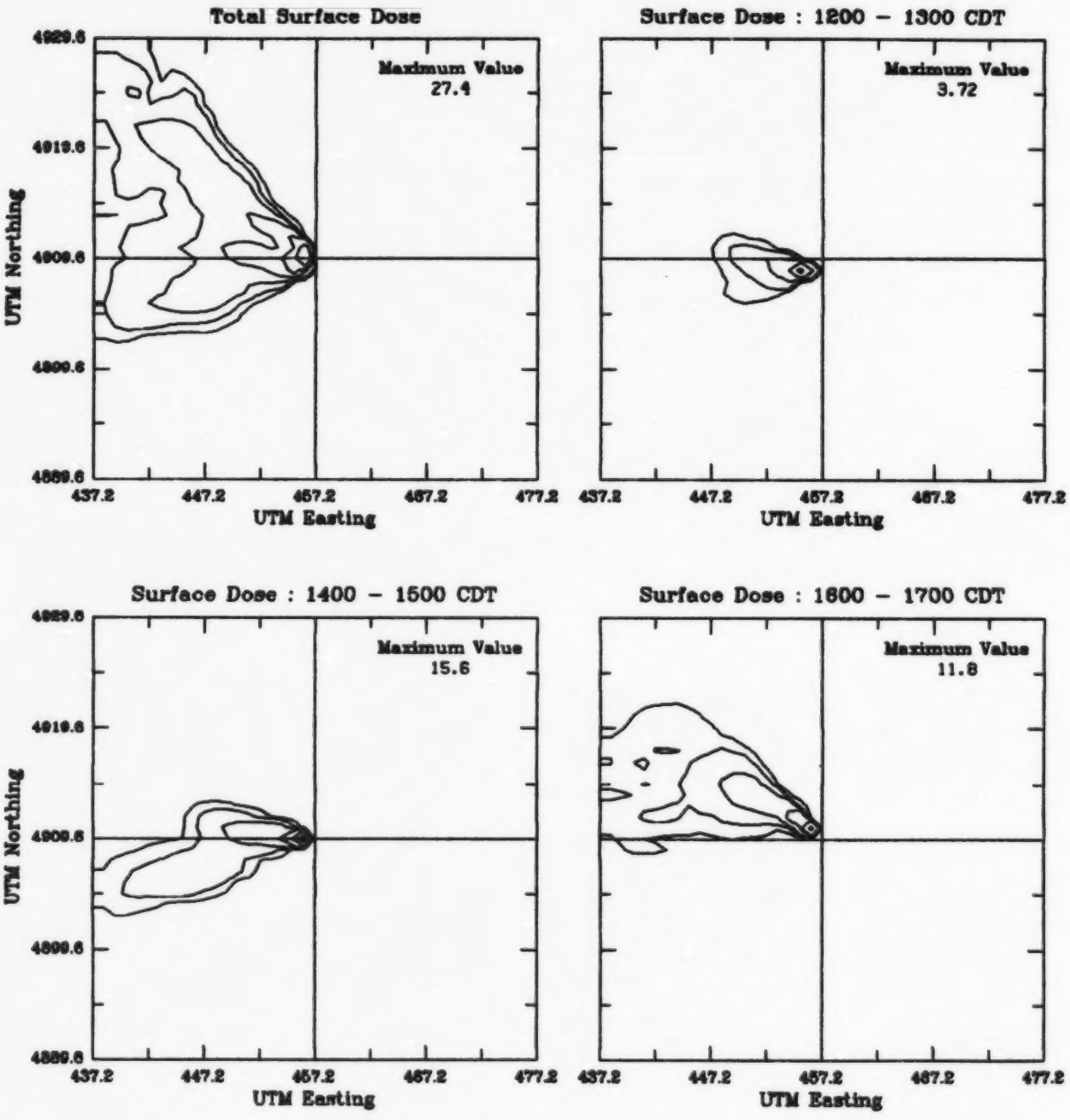


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ADPIC : TEST 3

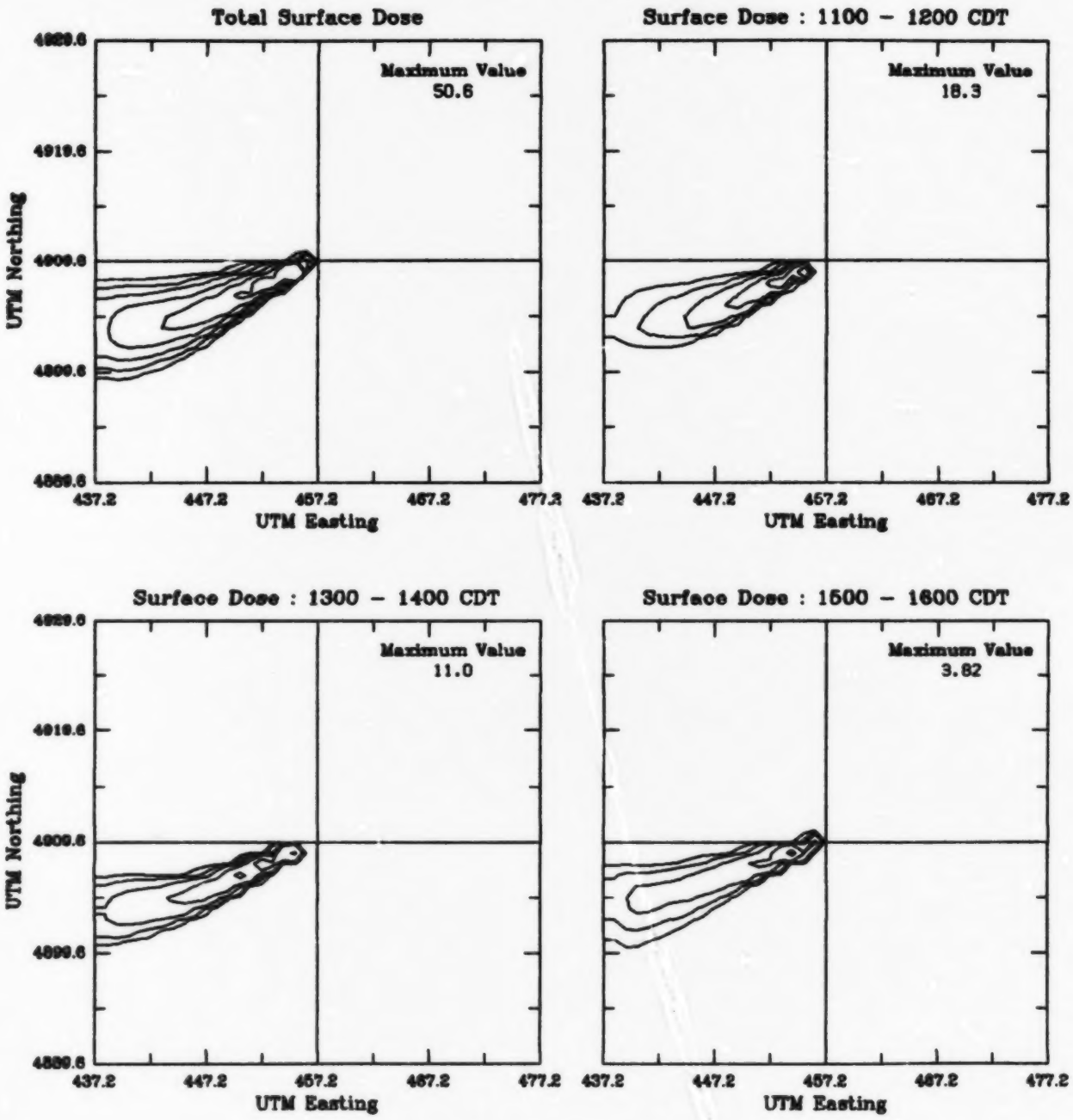


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ADPIC : TEST 4

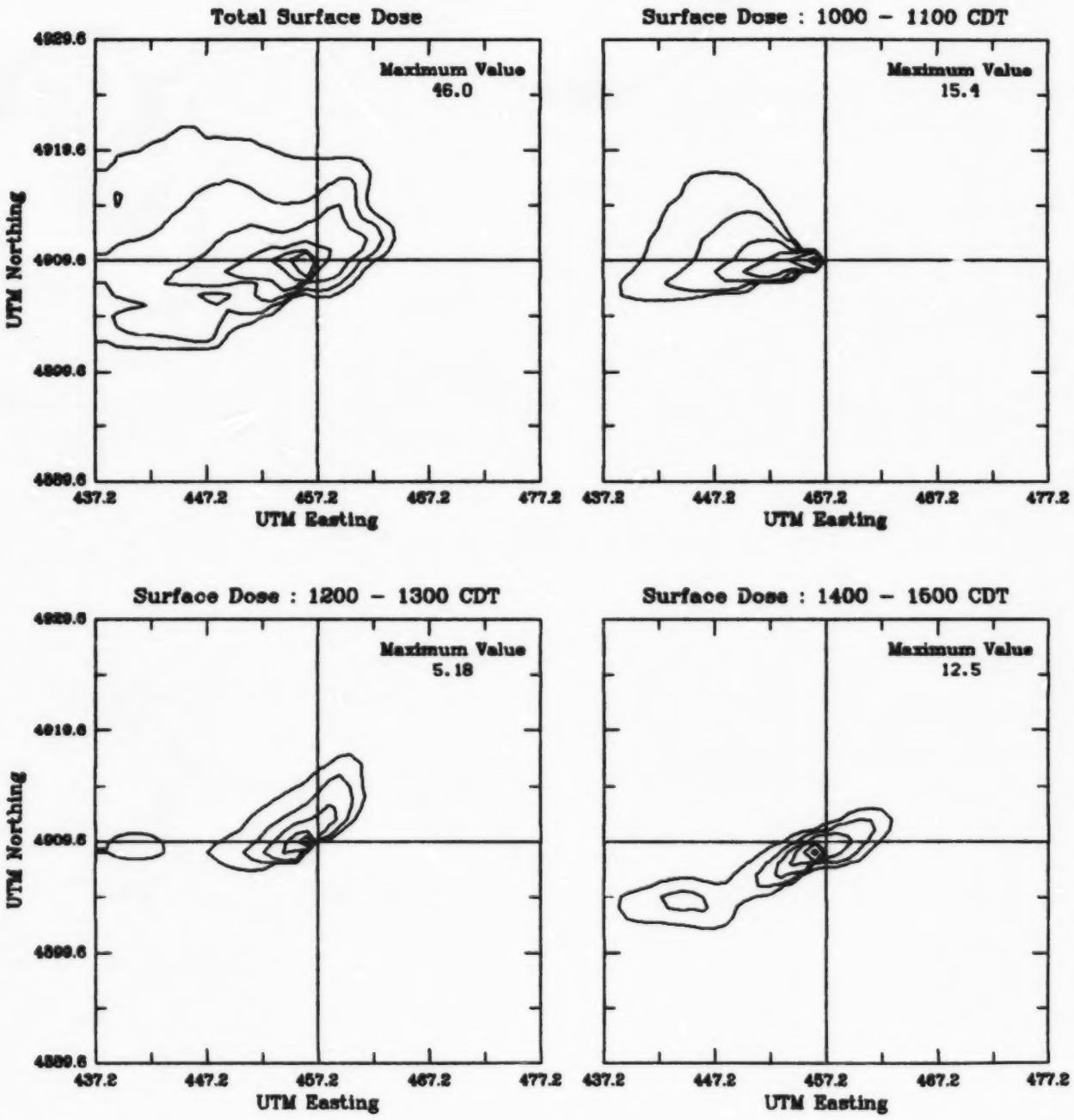


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ADPIC : TEST 5



6 Contours : (PPM-Sec)

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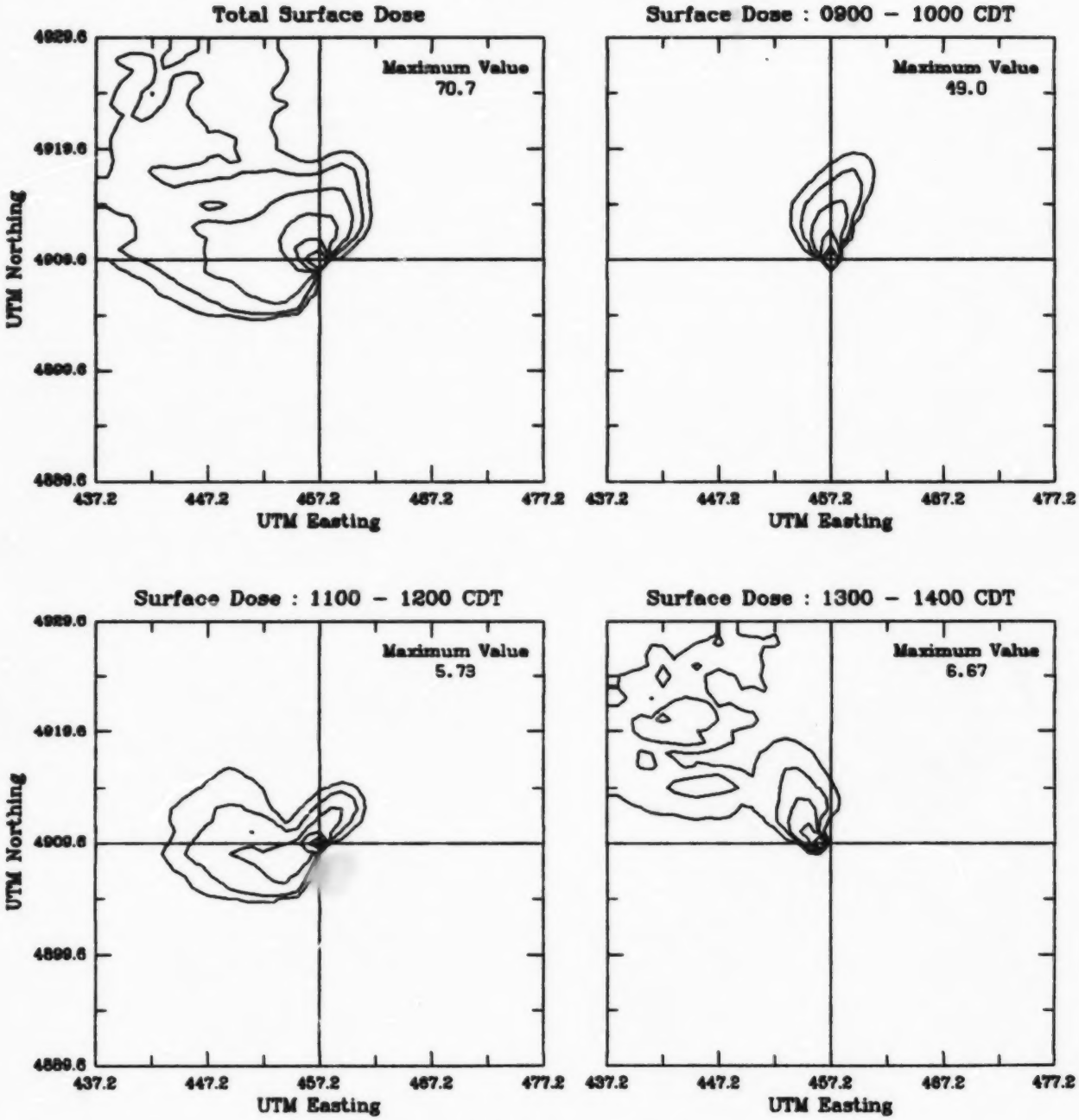
BEST COPY AVAILABLE

143

ADPIC : TEST 6

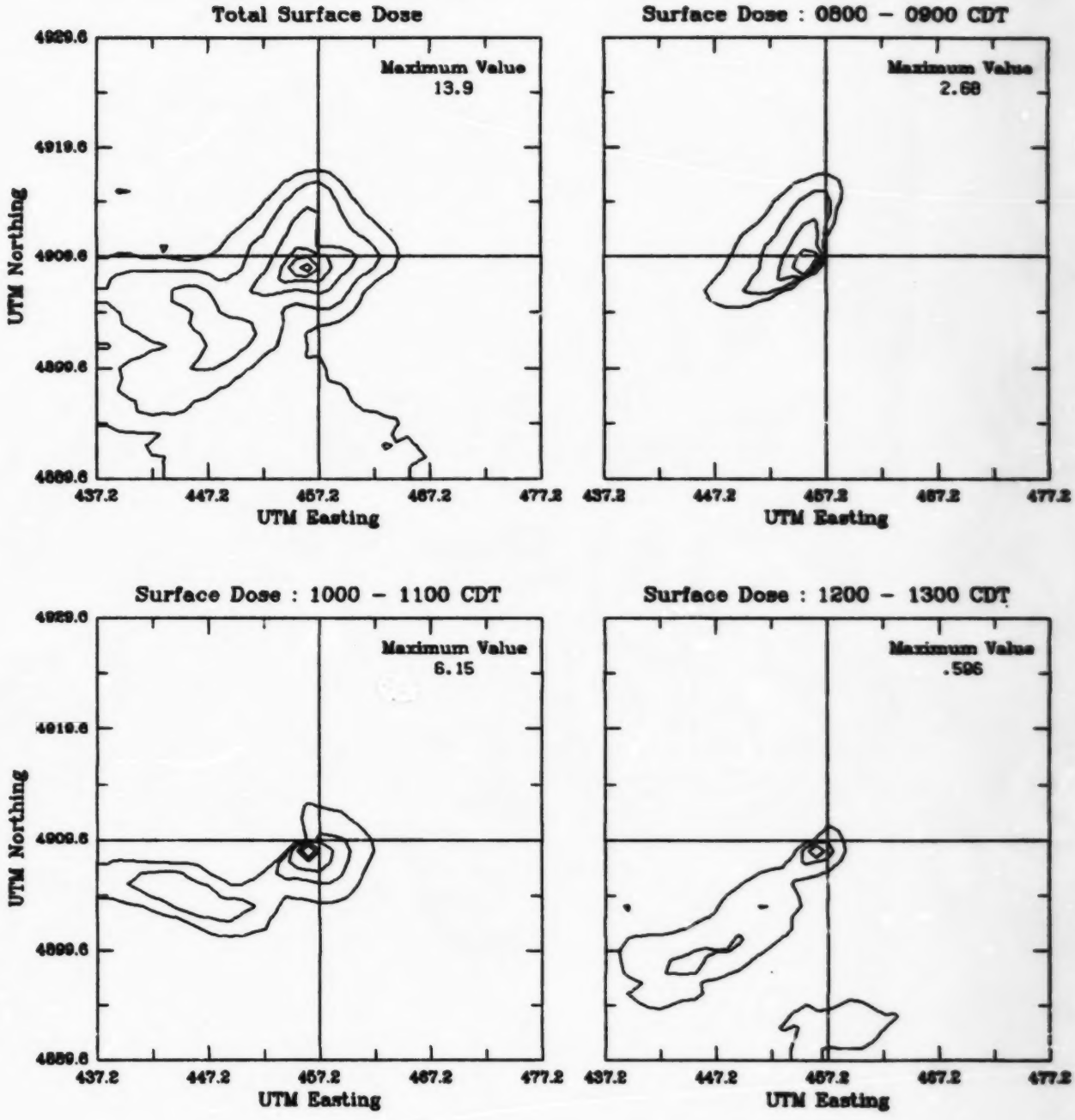


6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

BEST COPY AVAILABLE

ADPIC : TEST 7



6 Contours : (PPM-Sec)
0.03 0.10 0.30 1.00 3.00 10.0

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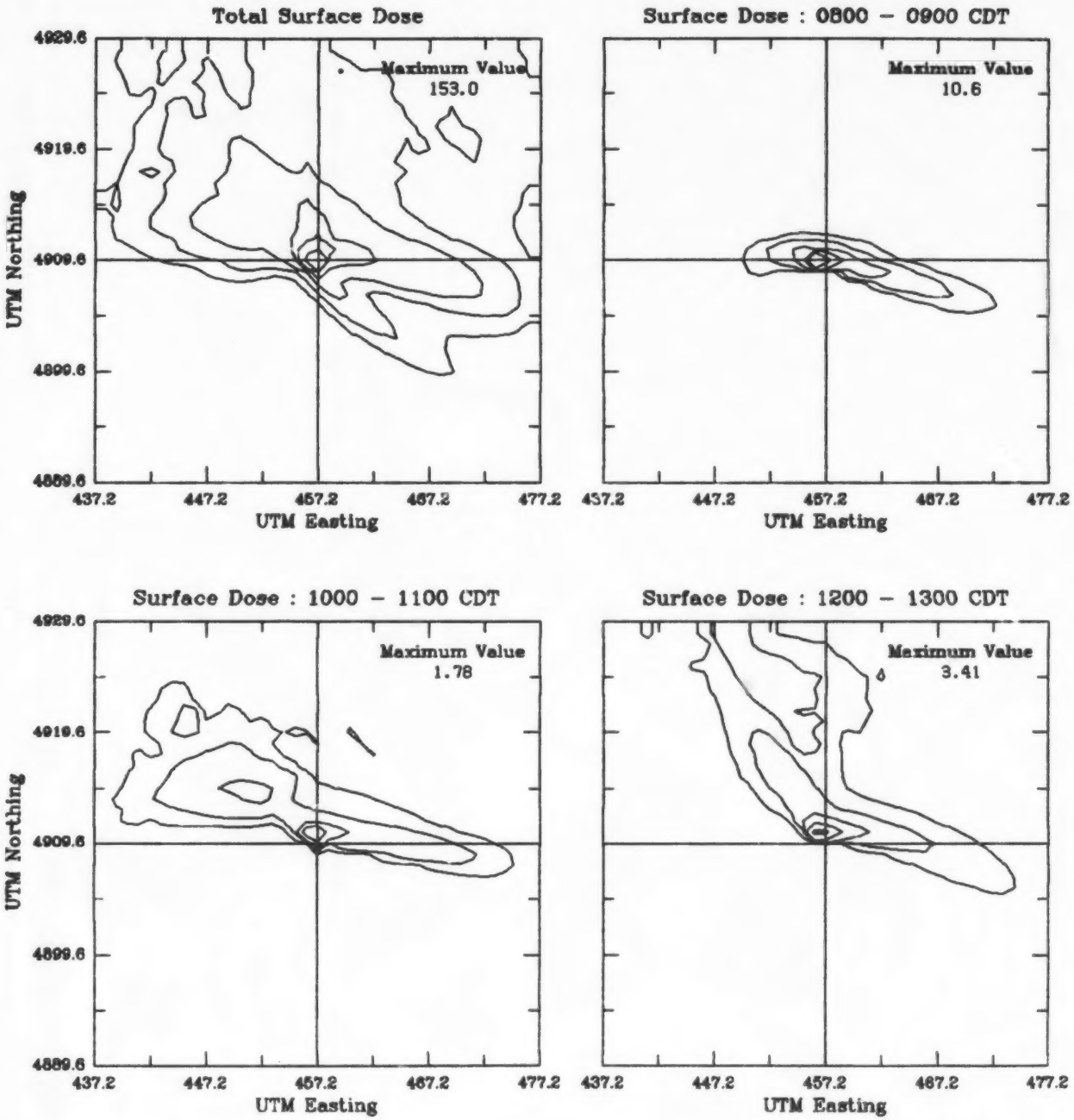
195

ADPIC : TEST 8



6 Contours : (PPM-Sec)

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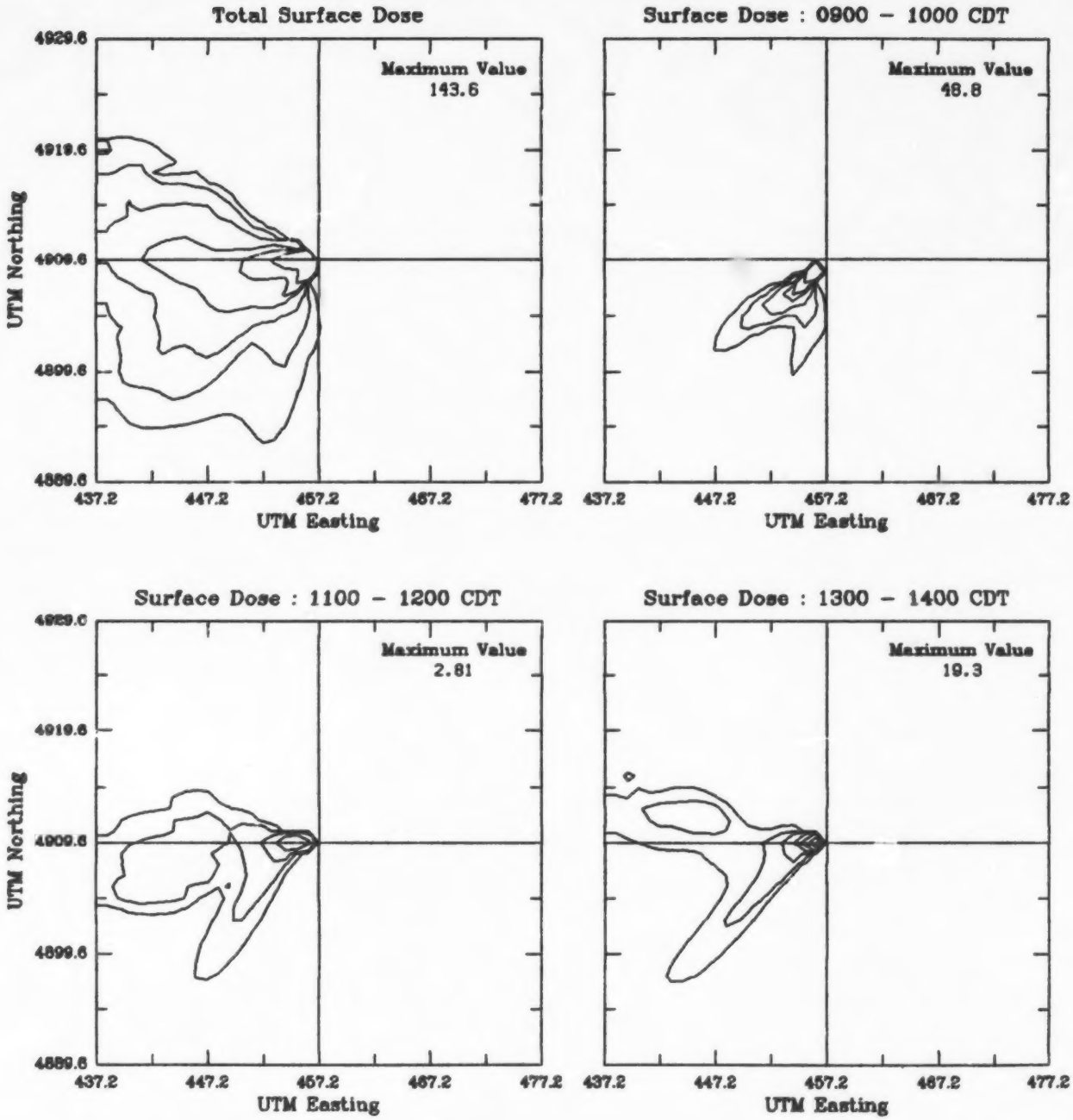
ADPIC : TEST 9



6 Contours : (PPM-Sec)

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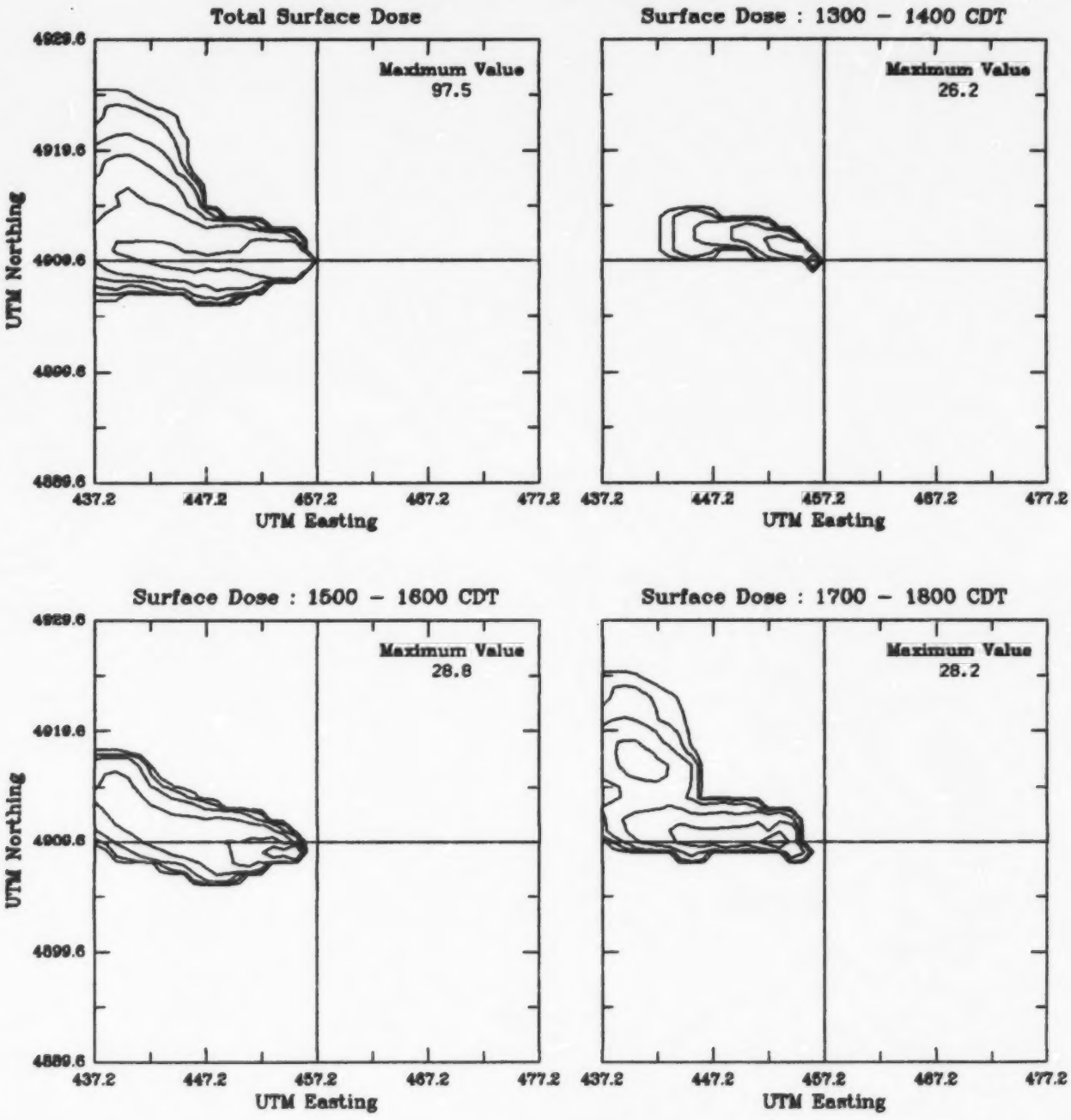
SPLIT : TEST 2



6 Contours : (PPM-Sec)

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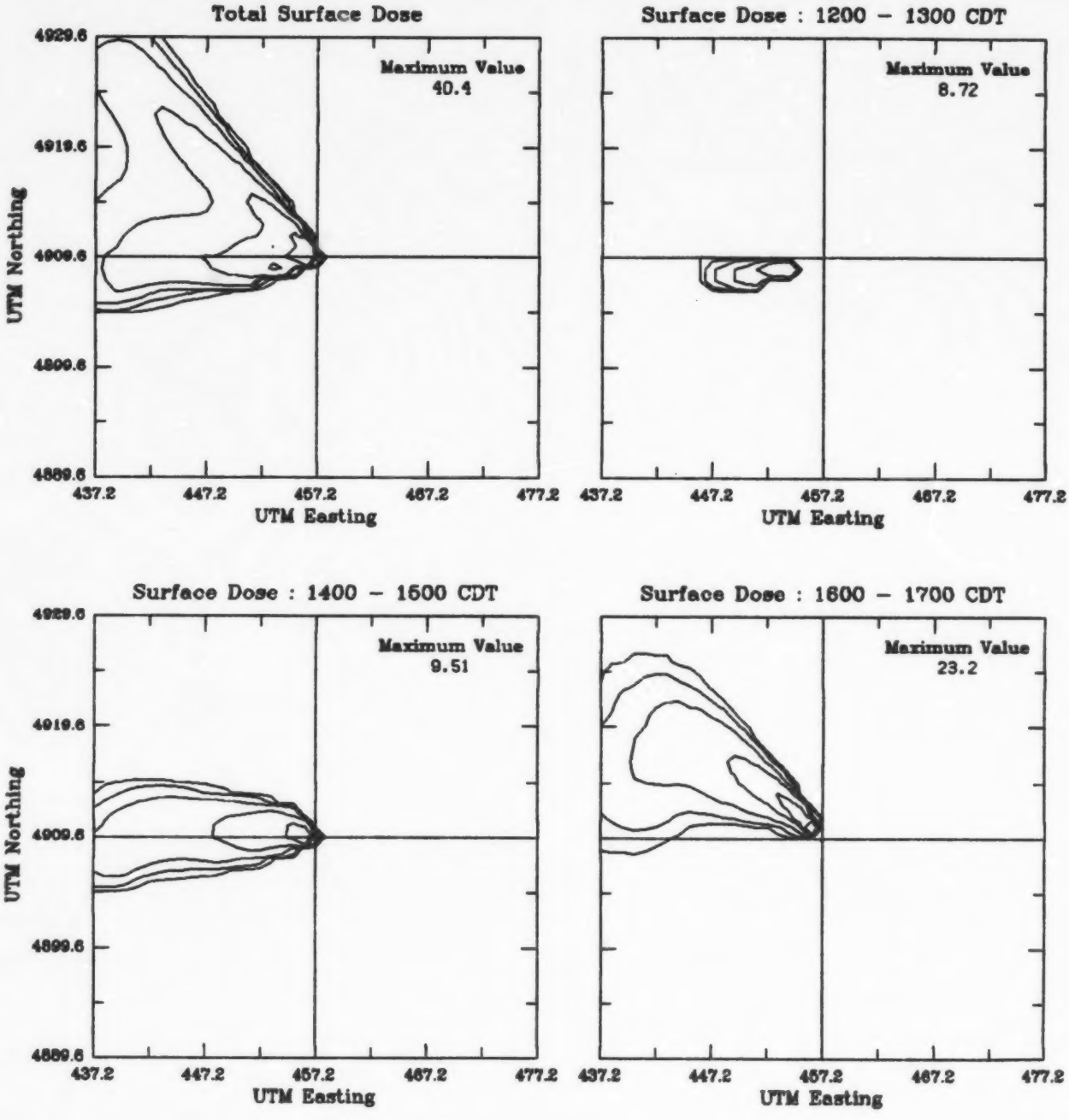
SPLIT : TEST 3



6 Contours : (PPM-Sec)

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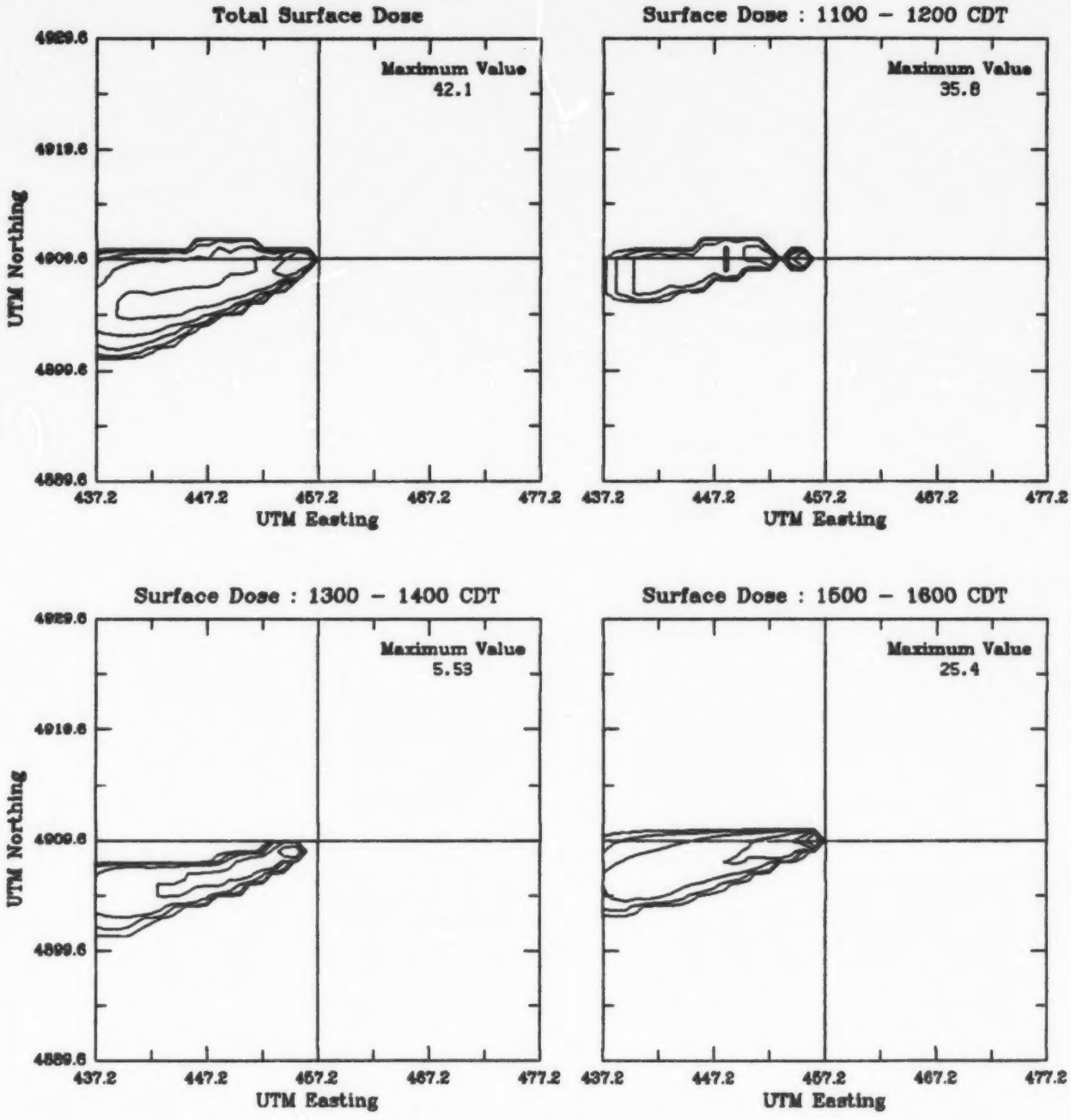
SPLIT : TEST 4



6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

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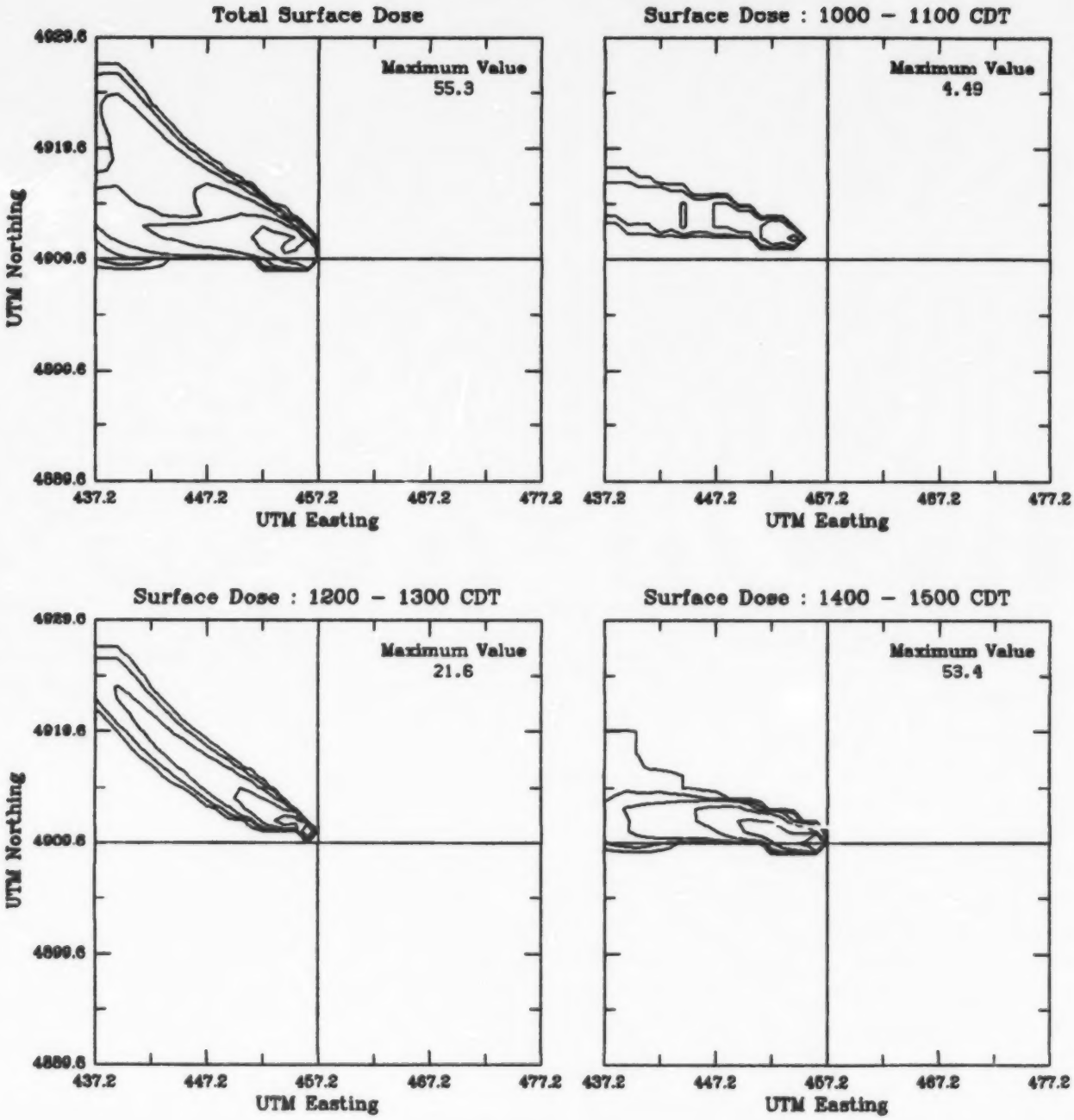
SPLIT : TEST 5



6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

151

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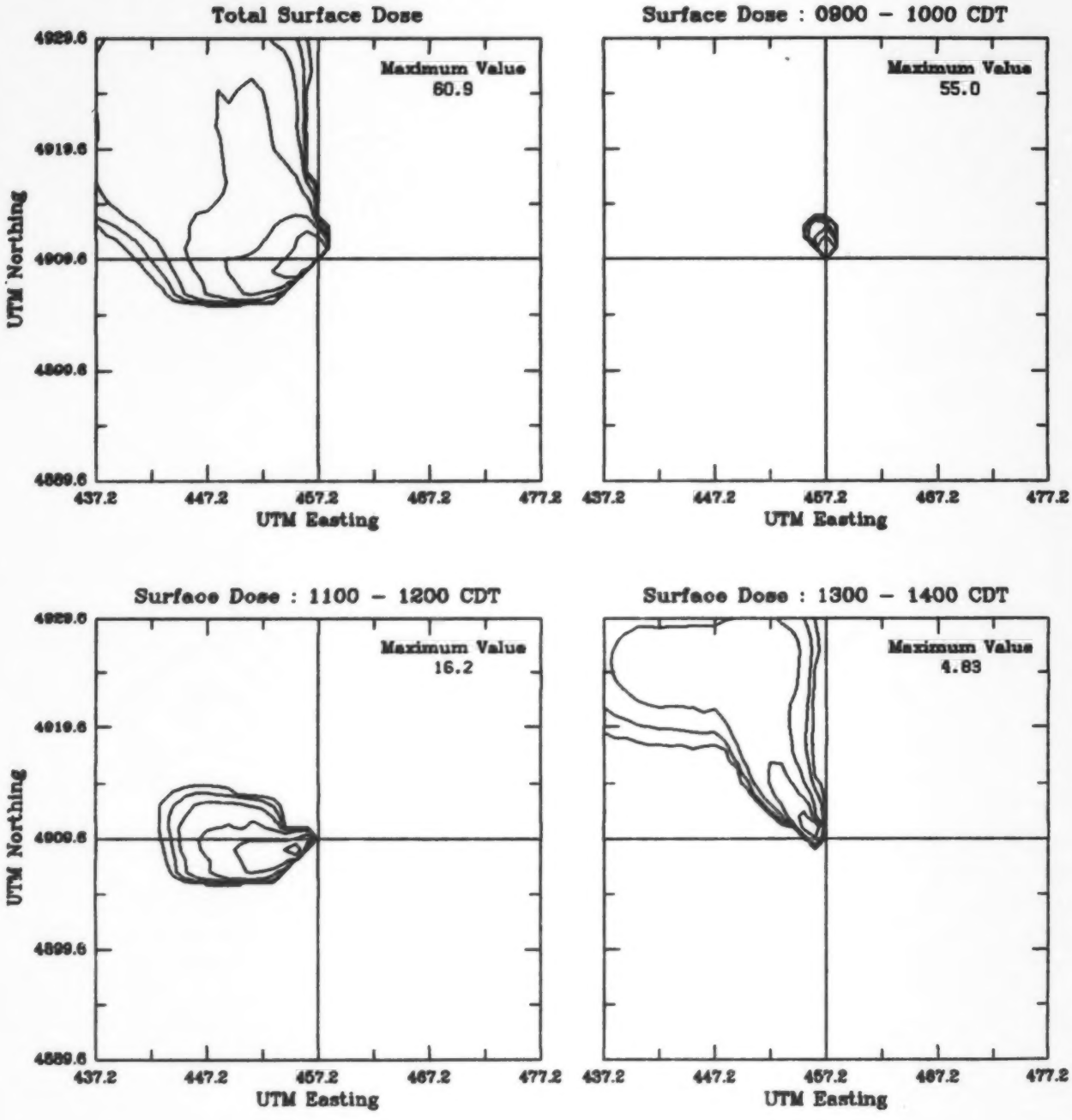
SPLIT : TEST 6



6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

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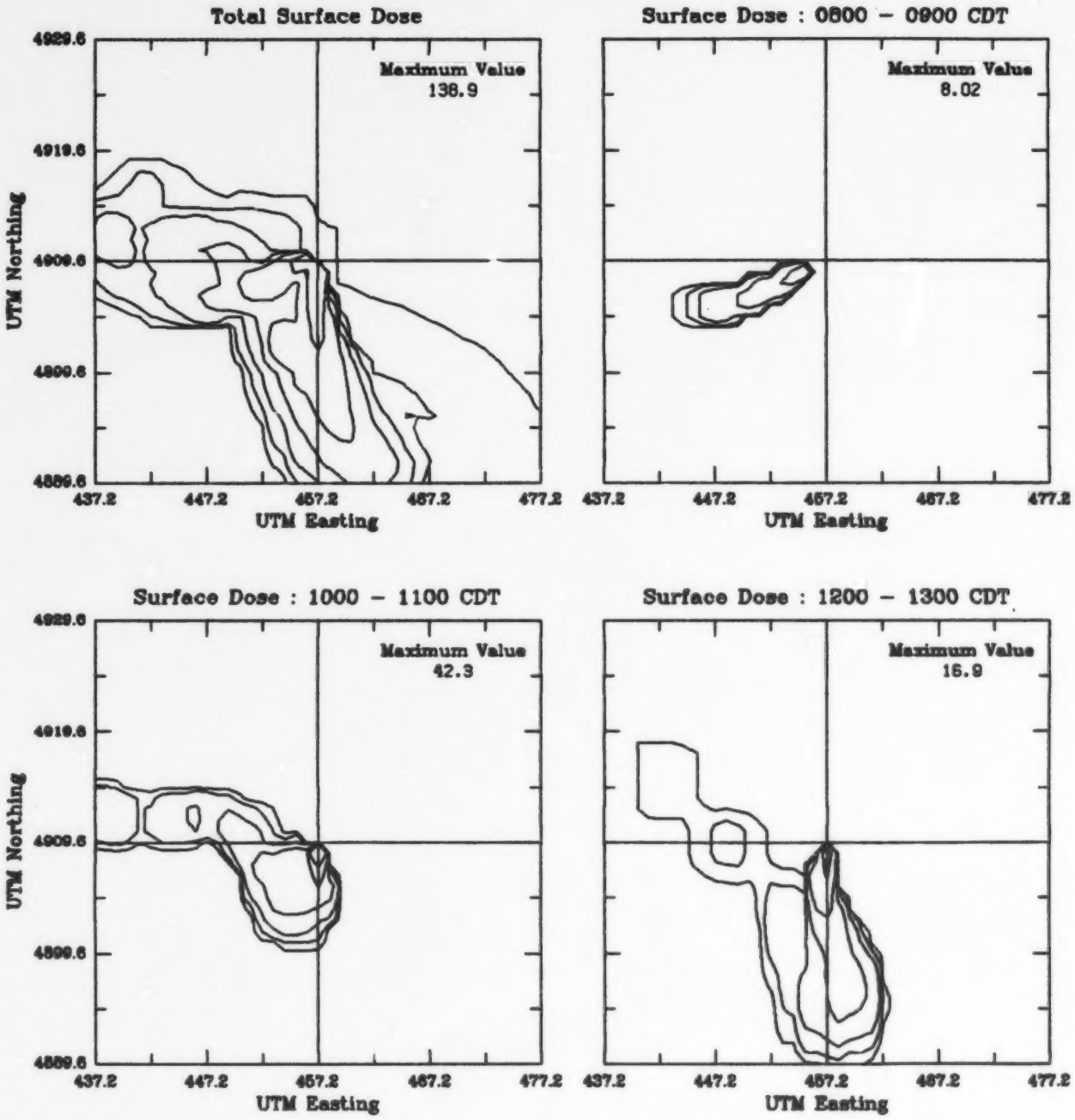
SPLIT : TEST 7



6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

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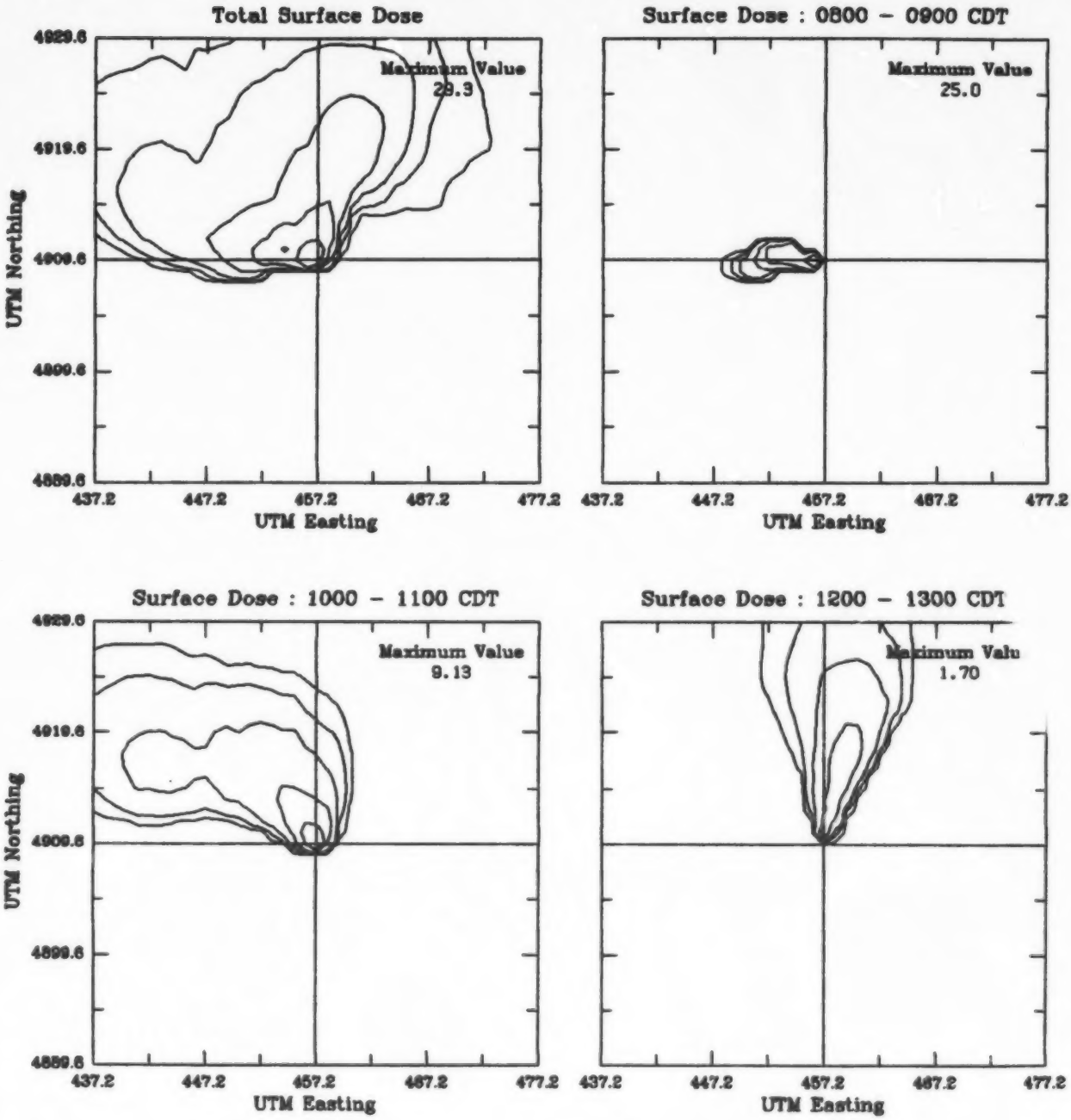
SPLIT : TEST 8



6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

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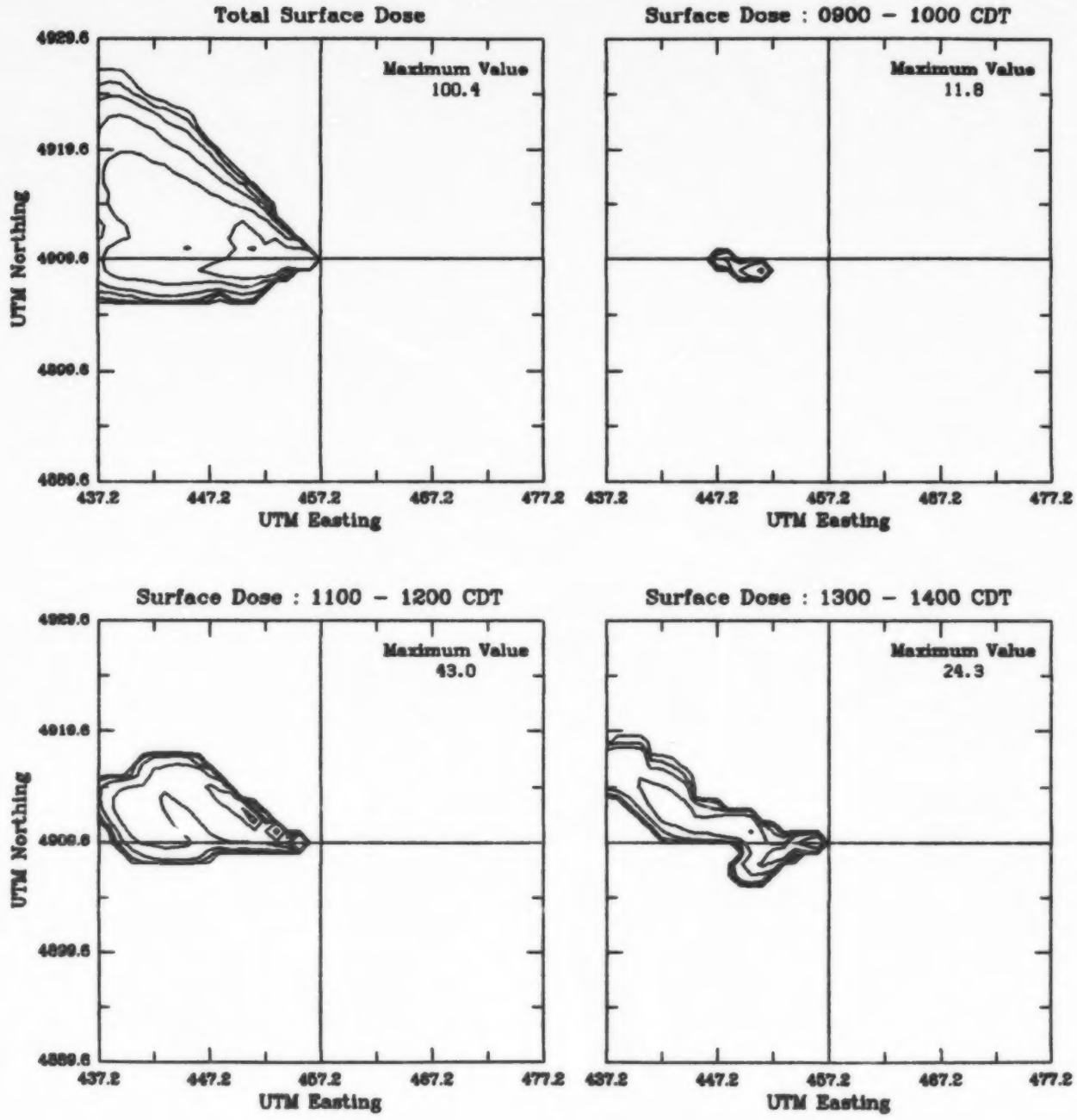
SPLIT : TEST 9



6 Contours : (PPM-Sec)

0.03 0.10 0.30 1.00 3.00 10.0

155

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7. AUTHOR(S)
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16 ABSTRACT (200 words or less)

The results from simulations by 12 dispersion models are compared with observations from an extensive field experiment conducted by the Nuclear Regulatory Commission in a shoreline environment during the early summer 1982. Ten of these models are the same as used in the earlier comparisons with the 1981 field tests at Idaho National Engineering Laboratory. All the models performed better on this SEADEX experiment. Little difference between the models is evident with hourly surface data, with the models able to predict the maximum value in the neighborhood of a sampler site within a factor of 2 approximately 25% of the time. This is raised to approximately 40% when the comparison is based on 12 hour integrated dose. For the longer time samples the more sophisticated models do show a distinct advantage when measured by correlation coefficient and root mean square error. If the data file is assumed incomplete, with higher data samples possible between the actual data samples, then the best results for the hourly samples show over 60% calculated within a factor of 2 when a 15° uncertainty in the plume position is permitted. This is raised to 90% for the 12 hour dose on the same comparison basis.

17. KEY WORDS AND DOCUMENT ANALYSIS

17a. DESCRIPTORS

atmospheric dispersion
concentration patterns
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Gaussian plume models
model evaluations
plume trajectories
puff models

17b. IDENTIFIERS OPEN-ENDED TERMS

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